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JUL 20 2011

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Dear Regulatory Team Members:

Enclosed please find the *Final, Technical Memorandum to Support the Unrestricted Radiological Release of Building 140 Including the Suction Channel and Discharge Piping, Hunters Point Naval Shipyard, San Francisco, California*. The Final Technical Memorandum and response to comments include all documentation to support evaluation for unrestricted release of the Building 140 structure including the pump pit, suction channel, and discharge piping. Technical Review of the enclosed technical memorandum has been completed by the Navy's Radiological Affairs Support Office.

This Technical Memorandum summarizes the investigation related to the B-140 structure, pump pit, suction channel, and discharge piping. A final status survey was performed on the discharge channel and the results are documented in the *Final, Final Status Survey Results, Building 140 Discharge Channel, February 2011*. Based on the investigations, surveys, and data presented within these two reports, the Navy is recommending unrestricted radiological release of all components of Building 140.

The Navy requests regulatory review of the Final Building 140 Technical memorandum **no later than Monday, August 22, 2011**. If you have questions regarding this request and the enclosed documents, please contact Mr. Chris Yantos at (619) 532-0912, or Mr. Keith Forman at (619) 532-0913.

Sincerely,

KEITH FORMAN
BRAC Environmental Coordinator
By direction of the Director

Enclosure: 1. Final, Technical Memorandum to Support the Unrestricted Radiological Release of Building 140 Including the Suction Channel and Discharge Piping, Hunters Point Shipyard, San Francisco, California, July 2011.

JUL 20 2011

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Program Management Office West
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**CONTRACT No. N62473-07-D-3211
CTO No. 0018**

FINAL

**TECHNICAL MEMORANDUM TO SUPPORT
UNRESTRICTED RADIOLOGICAL RELEASE OF
BUILDING 140 INCLUDING THE SUCTION CHANNEL
AND DISCHARGE PIPING**

July 20, 2011

DCN: ECSD-3211-0018-0177

**HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA**

Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

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July 20, 2011

**HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA**

DCN: ECSD-3211-0018-0177

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TABLE OF CONTENTS

	<u>PAGE</u>
ABBREVIATIONS AND ACRONYMS	iii
1.0 INTRODUCTION	1-1
1.1 BUILDING 140 BACKGROUND	1-2
1.2 DRYDOCK 3 OPERATIONS	1-3
2.0 PRIOR INVESTIGATIONS AND SURVEYS	2-1
2.1 BUILDING 140	2-1
2.2 PUMP PIT	2-2
2.3 DISCHARGE CHANNEL	2-3
2.4 DISCHARGE PIPING	2-4
2.5 SUCTION CHANNEL	2-4
2.6 COLLECTOR CHANNEL	2-4
3.0 RESULTS EVALUATION	3-1
4.0 REFERENCES	4-1

FIGURES

Figure 1-1	Regional Location Map
Figure 1-2	Building 140 Location Map
Figure 1-3	Color Coded Map of Building 140 Components

ATTACHMENTS

Attachment 1	May and June 2008 Initial Building 140 Investigation Data
Attachment 2	July 2009 Discharge Piping Sample Data
Attachment 3	RESRAD Modeling
Attachment 4	Response to Comments

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ABBREVIATIONS AND ACRONYMS

bgs	below ground surface
^{137}Cs	cesium-137
DON	Department of the Navy
FSS	Final Status Survey
HPS	Hunters Point Shipyard
HRA	Historical Radiological Assessment
Kcpm	kilocounts per minute
mrem/y	millirems per year
PCB	polychlorinated biphenyl
pCi/g	picocuries per gram
pCi/mL	picocuries per milliliter
^{239}Pu	plutonium-239
^{226}Ra	radium-226
^{90}Sr	strontium-90

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1.0 INTRODUCTION

The Department of the Navy (DON) has prepared this Technical Memorandum to summarize the background and activities that support the unrestricted radiological release of Building 140, including the suction channel and discharge piping. Building 140 is located in Parcel B within Hunters Point Shipyard (HPS), San Francisco, California (Figures 1-1 and 1-2).

The pumping equipment that was used to dewater Drydock 3 at HPS was housed in Building 140. The building is currently unoccupied, and the pumping equipment within it is totally inoperable and in a state of disrepair. In its current condition, Building 140 and its equipment are incapable of dewatering Drydock 3.

Volume II of the Historical Radiological Assessment (HRA) (NAVSEA 2004) for HPS indicates that the structures located beneath Building 140 are radiologically impacted because of its association with Drydock 3. This drydock was historically used as a decontamination facility for ships that participated in atomic weapons testing, as the possible location where radium-bearing devices were removed from ships during maintenance, and as the former location of radium-bearing devices. Because of the nature of the dewatering operations from Drydock 3, the interior portions of the suction channel, discharge piping, and discharge channel may have become contaminated with decontamination wastes. The radionuclides of concern listed in the HRA for Building 140 and Drydock 3 are cesium-137 (^{137}Cs), plutonium-239 (^{239}Pu), radium-226 (^{226}Ra), and strontium-90 (^{90}Sr).

The purposes of this Technical Memorandum are to:

- Describe and detail the activities and operations of Drydock 3.
- Present results of the radiological scoping surveys performed at Building 140 and the surrounding area.
- Describe the physical characteristics of the Building 140 components and assess the nature of their operations and any possible radiological impact to human receptors.
- Evaluate the results of the surveys and assessments in terms of risk to human health and the environment.

This Technical Memorandum is organized as follows:

- Section 1.0, Introduction – Provides the background for Building 140 and a summary of dewatering and flooding operations at Drydock 3.
- Section 2.0, Prior Investigations and Surveys – Presents a summary of the results of the DON investigative and survey activities performed at Building 140 and its components.

- Section 3.0, Results Evaluation – Presents the evaluation of the various investigation and survey results.
- Section 4.0, References – Provides the references cited in this Technical Memorandum.
- Attachment 1 – May and June 2008 Initial Building 140 Investigation Data.
- Attachment 2 – July 2009 Discharge Piping Sample Data.
- Attachment 3 – RESRAD Modeling.
- Attachment 4 – Response to Comments.

1.1 BUILDING 140 BACKGROUND

Building 140 is a one-story, rectangular-shaped brick building with a rounded eastern end resembling an apse. The building measures about 96 by 56 feet and is located north of Drydock 3, about midway along the drydock. The collector channel for dewatering of Drydock 3 passes in a straight line north beneath the entire drydock, into the underground suction channel, and up through the discharge piping to San Francisco Bay via a surface discharge channel, with the pumps and control equipment for this process being housed in Building 140.

Building 140 is eligible for listing on the National Register of Historic Places. It meets the criteria for exceptional significance (PAR 1998).

Based on new information concerning the construction and operation of Drydock 3 (see Figure 1-3 notes), Building 140 and the associated channels, pumps, and piping have been divided into six components as shown on Figure 1-3. The components are color coded on the figure as follows:

- Collector Channel (dark purple) – The water in the drydock flows through a series of covered culverts along the side of the drydock and through sand traps to remove particulate matter prior to entering the collector channel. The collector channel is a grating-covered open culvert approximately 107 feet in length located directly beneath the drydock feeding the suction channel. Although the collector channel is an integral part of the Drydock 3 dewatering operations, its location beneath the floor of Drydock 3 places this structure in Parcel F, outside the scope of the Building 140 radiological investigation. See Figure 1-3, which shows the Parcel B boundary.
- Suction Channel (light purple) – This is the 12-foot-wide concrete pipe that extends from 58 to approximately 70 feet below ground surface (bgs), located on the north side of Drydock 3. This channel extends approximately 107 feet from the north face of Drydock 3 under the center of the pump pit area of Building 140.
- Building 140 (green) – This is the above-grade surface building structure that housed the six pumps and associated control panels used to dewater Drydock 3. These pumps provided the power to move the water from the suction channel and forced the water through the discharge piping into the discharge channel north of Building 140. Each of the four 750-horsepower pumps is associated with one of the 48-inch discharge pipes used to dewater the drydock. The two 100-horsepower pumps were used to keep the

drydock free of water during ship maintenance and/or repair activities, and this water discharged through the 20-inch discharge pipe.

- Pump Pit (light blue) – This is the circular pit that extends approximately 52 feet bgs from Building 140 and has spiral staircases extending to three separate intermediate platforms from Building 140 to the pit bottom. At the bottom of the pit, 4 feet of concrete separates the pump pit from the suction channel.
- Discharge Piping (yellow) – Consists of four 48-inch cast iron pipes in an “S” shape that connect the suction channel to the discharge channel 52 feet above. These 48-inch discharge pipes were used exclusively during dewatering operations, and the end of each 48-inch discharge pipe terminated with a hinged cast iron check valve that acted as a backflow preventer when there was no discharge from the pipe.

In addition, the water that infiltrated the drydock during ship maintenance activities was discharged through a 20-inch cast iron pipe. This discharge pipe entered the-discharge channel above the 48-inch discharge pipes and extended an additional 20 feet to discharge water beyond the two cast iron check valves that acted as additional backflow preventers for the 48-inch pipes. This discharge pipe was located at the top of the discharge channel above the high tide mark. The elevation of this discharge pipe in conjunction with the backflow preventers in the 48-inch discharge piping prevented water from back-flowing into the drydock.

- Discharge Channel (orange) – A concrete structure that is 8 feet tall, 16 feet wide, and 146 feet long that receives water from the discharge piping, which flows north of Building 140 and discharges into the San Francisco Bay. The discharge channel contained two cast iron check valves used as backflow preventers approximately 20 feet north of where the discharge pipes enter the discharge channel. Opening of these valves during drydock dewatering operations required the use of a winch located on top of the discharge channel.

Until a cofferdam was installed in 2009, the discharge channel was open to the bay and under daily tidal influence.

1.2 DRYDOCK 3 OPERATIONS

Drydock 3 is a graving-type drydock that has generally been in its current configuration since original construction was completed in 1919 (DoD 1988). The Navy acquired HPS from Bethlehem Steel’s marine division and took over operations of Drydock 3 on December 15, 1941.

In 1952, the entire drydock floor, which was of timber construction, was replaced with a reinforced concrete floor. Also, additional stairways were provided, sections of the deck wall were repaired, and salt water, compressed air, and chemical service lines were provided the full length on both sides near the bottom of the drydock (NAVSEA 2004).

Drydock 3 was designed to dewater in 150 minutes. Initially, the 48-inch, 750-horsepower pumps dewatered the drydock at a rate of 575,000 gallons per minute. As the water level

approached the dock floor, one or more of the main pumps would be shut down to prevent loss of pump suction. As the water level continued to recede, it generally became necessary to throttle the discharge of the last operating pump. The 16-inch, 100-horsepower drainage pumps cleared the dewatering pump suction chamber and drainage system at a flow rate of 8,500 gallons per minute (DoD 1988, 1989).

Flooding of Drydock 3 was completed in 90 minutes through ducts in an entrance closure caisson (DoD 1988). Drydock 3 was designed to hold 45,077,940 gallons with the collector channel, suction channel, and sump designed to hold an additional 290,000 gallons.

An entrance closure caisson is built like the hull of a ship, with a keel and a stem at both ends. When the caisson is empty, it floats and may be moved to admit a vessel being floated into the dock. The caisson is placed back at the entrance and filled with water, thereby sinking into the grooves intended for it and closing the graving dock. Drydock 3 is flooded through ducts that penetrate the caisson shell through the caisson ballast tank.

Placing ship(s) into Drydock 3 required two flooding and two dewatering operations:

- First, the caisson was set and the drydock was dewatered to allow workers to enter the drydock and place keel blocks in a configuration that supported the vessel's hull during maintenance activities.
- The drydock was then flooded using the ducts in the caisson to control the rate of flooding, to minimize the amount of bay sediments entering the drydock, and to avoid displacement of the keel blocks.
- The entrance closure caisson was then removed to allow the ship to enter the drydock. The ship was centered over the keel blocks, the caisson was set, and the drydock was then dewatered, leaving the ship dry and supported on keel blocks.
- Once the ship repairs or maintenance was complete, the ducts in the caisson were used once again to flood the drydock. The caisson was then removed to allow the ship to exit the drydock.

Records indicate that it was common practice to have multiple ships in Drydock 3 undergoing repairs and maintenance at one time. To ensure a safe work environment in the drydock, water infiltration from various sources was managed through a series of floor drains that sloped from the centerline of the drydock to a culvert system running along both sides of the drydock and into the collector channel through sand traps used as filters to remove particulate matter (DoD 1989).

2.0 PRIOR INVESTIGATIONS AND SURVEYS

As stated in Section 1.0, the HRA (NAVSEA 2004) indicated that Building 140 is radiologically impacted because of its association with Drydock 3. Drydock 3 was historically used as a decontamination facility for ships that participated in atomic weapons testing, as the possible location of removal of radium-bearing devices from ships during maintenance, and as the former location of radium-bearing devices. The various decontamination methods for ships that participated in atomic and nuclear weapons testing included sandblasting of shipboard components and acid washing of desalinization systems.

During dewatering operations, residual decontamination wastes may have been drawn into the collector channel located at the bottom of Drydock 3 and into the suction channel and then forced through the discharge piping using the pumps housed in Building 140, thereby potentially contaminating the discharge channel and subsequently entering the bay. Because of the construction of the dewatering system from Drydock 3, only the interior portions of the suction channel, discharge piping, and discharge channel could possibly have become contaminated with decontamination media.

This section provides a summary of the investigations and surveys performed to date for the Drydock 3 dewatering system (i.e., Building 140 components). This dewatering system consists of six main components: Building 140, the pump pit, the discharge channel, discharge piping, the suction channel, and the collector channel. These components are shown on Figure 1-3 and are described in Section 1.1.

2.1 BUILDING 140

Building 140 is currently unoccupied, with the pumping equipment contained therein totally inoperable and in a state of disrepair. Building 140, in its current condition, is incapable of dewatering Drydock 3. No previously documented radiological investigation has been completed and the HRA indicates that potential contamination of Building 140 is unlikely. Recommended actions from the HRA include a scoping survey of the structure.

An initial inspection of Building 140 was conducted on May 7, 2008. The inspection indicated evidence of vandalism of the various electrical components and control panels. On the floor was an oily fluid containing polychlorinated biphenyls (PCBs) that appeared to have leaked from the large, deck-mounted motors. In addition, general trash and debris were strewn about the structure.

On May 10, 2008, workers in appropriate personal protective equipment collected the trash and debris in Building 140. An absorbent material was used to remove the PCB-containing oil from

the floor. This trash, debris, and PCB-laden absorbent material were turned over to the DON's basewide transport and disposal broker for off-site disposal. The electrical and motor controller cabinets opened by the vandals were closed.

On July 22, 2008, the permanently mounted electrical cabinets containing dials and gauges were scanned for the presence of ^{226}Ra using a Ludlum Model 2350-1 data logger paired with a Ludlum Model 44-10 detector. A total of 69 dials and gauges in the pump house and the electrical equipment room were scanned, and no elevated readings were noted. The scan range of the inner walls of the building was 7.8 to 11.4 kilocounts per minute (Kcpm). The scan range of the electrical control panels was 12 to 15 Kcpm. The scan range of the electrical panels located in the west end of the building was 6.9 to 12.8 Kcpm. The scan range of the electrical panels located in the center of the building was 12.5 to 15.5 Kcpm. The scanning locations are shown on Figure 1 in Attachment 1. The radiation contamination survey forms are also provided in Attachment 1.

2.2 PUMP PIT

From the available historical drawings and site reconnaissance, the pump pit was accessed through an opening in the floor leading to staircases that extend downward to the centrifugal pumps used for dewatering and draining the drydock via three intermediate platforms. At ground level in Building 140, six separate motors were used to turn shafts that extended through the floor to the bottom of the pump pit where the pumps were actually located. Due to the distance between the motors and actual pumps, the shafts required support to retain proper alignment. Shaft alignment would have been achieved using bearings that were anchored to the 4-foot-thick concrete floor separating the pump pit from the suction channel. In the pump pit, three intermediate platforms gave pump house operators the ability to inspect bearings, motor shafts, and shaft alignment at several places to ensure proper operation of the pump house system.

During the initial inspection on May 7, 2008, it was discovered that direct access from Building 140 to the bottom of the pump shaft had been blocked as a safety precaution. Access beyond roughly 10 feet below the floor's surface via the staircase is no longer available because the pump pit is flooded to this level. The source of the flooding is unknown, but the general water level appears to be relatively stable and unaffected by seasonal or tidal water action.

On May 12, 2008, an underwater video camera attached to a dive light was used to conduct an inspection of the flooded pump pit to identify areas where sediment may have collected. Four of the five manholes were used to access the pump pit area down to 52 feet bgs (see Figure 2 in Attachment 1). The images from the camera revealed algae growth and various corrosion products. Underwater video camera images of the pump shaft pit showed that sediment was not present in sufficient quantity to sample.

A weighted stream sampler was used to collect a sample of water and debris that had accumulated on the bottom of the pump shaft area. A hand auger was modified with a scraper attached with pipe clamps to agitate the bottom material. Aqueous samples were collected from the manholes on May 19, 2008, and were submitted to the on-site laboratory for analysis. The analytical results did not indicate any elevated readings beyond those normally expected from samples of similar media. The ^{226}Ra activity ranged from -0.198 to -0.756 picocuries per milliliter (pCi/mL), and ^{137}Cs activity ranged from 0.0123 to 0.0594 pCi/mL. The sample locations and summarized analytical results are presented on Figure 2 in Attachment 1. The gamma spectroscopy data are also provided in Attachment 1.

2.3 DISCHARGE CHANNEL

Because of the nature of the decontamination activities in Drydock 3, a scoping survey (designed as a Final Status Survey [FSS]) of the discharge channel was performed to determine if these prior activities had radiologically impacted the interior surfaces of the discharge channel. The FSS of the discharge channel began in January 2009 and was completed in July 2009.

Before the start of the FSS, the sediment present in the discharge channel had to be removed to allow access to the concrete structure. The sediment was sampled and results indicated ^{137}Cs at 0.23 picocurie per gram (pCi/g) and ^{226}Ra at 2.289 pCi/g. To ensure safe access for sediment removal, the concrete discharge channel lid was cut and removed, and a cofferdam was installed to isolate the discharge channel from the bay. Armor rock was then placed on the bay side to dissipate energy from wave action. To stop the influx of tidally influenced water into the discharge channel from the discharge piping, inflatable plugs were installed in the discharge piping before the check valve leading into the discharge channel. The hinged check valves were further secured using clamps to complete the isolation of the discharge channel. To minimize the need for dewatering the discharge channel, the cofferdam was installed at low tide. Once the discharge channel was deemed safe to enter, the saturated sediments remaining in the bottom of the discharge channel were removed and turned over to the DON's basewide transport and disposal broker for off-site disposal.

The FSS involved dividing the channel into three Class 1 survey units. The concrete surfaces were surveyed for alpha, beta, and gamma radiation in accordance with the final Task-specific Plan for the Building 140 Discharge Channel Scoping Survey (TtEC 2008). Survey methods included fixed (static) and scan surface contamination surveys. Exposure rate measurements were performed at static reading locations, and swipe samples were obtained to evaluate the presence of loose alpha and beta-gamma radiation. All survey and sample results indicated that the discharge channel meets the release criteria and can be released for unrestricted use. All doses from the survey units indicated a maximum of 0.811 millirem per year (mrem/y) and a maximum excess lifetime cancer risk (increase) of 4.32×10^{-7} (in Survey Unit 3).

The draft Building 140 Discharge Channel FSS Report containing the survey results described above was issued for regulatory review on May 21, 2010. Regulatory agency comments on the draft FSS Report were received in June 2010. The final Building 140 Discharge Channel FSS Report was issued on February 15, 2011 (TtEC 2011).

2.4 DISCHARGE PIPING

In July 2009, during the survey of the discharge channel, four samples from the discharge piping were collected. Because of the inaccessibility of the piping for typical sampling, an improvised sampling technique was used to filter the cloudy water and trap enough floating material for a sample from each 48-inch discharge pipe. One sample had ^{137}Cs present at 0.2043 pCi/g. The other three samples did not have ^{137}Cs present that exceeded the release criterion of 0.113 pCi/g for ^{137}Cs in soil. The four samples did not have ^{226}Ra activity present that exceeded the release criterion of 1.485 pCi/g. For the sample with the elevated ^{137}Cs , no ^{90}Sr activity was detected. Attachment 2 provides a figure depicting the sample locations and a summary of the analytical results.

2.5 SUCTION CHANNEL

Because the suction channel is submerged to a depth of approximately 49 feet bgs and can only be accessed from land on Parcel B by excavating to a depth of 56 feet bgs, no direct measurements or media samples from the suction channel have been collected.

2.6 COLLECTOR CHANNEL

No previous investigations of the collector channel have been identified. The entire channel is in Parcel F and is completely submerged under approximately 49 feet of water. Any additional evaluation and investigation of the collector channel within Drydock 3 will be conducted as a component of the ongoing investigation and potential future remediation activities associated with Parcel F.

3.0 RESULTS EVALUATION

The DON is recommending unrestricted radiological release of Building 140 (Drydock 3 Pump House) located in Parcel B, including its components, the portion of the suction channel located in Parcel B, the pump pit, the discharge piping, and the discharge channel. The collector channel is located in Parcel F and will be addressed as part of the Parcel F response.

Based on the results of the gamma scan survey of the dials and gauges within Building 140, no elevated activity was identified. For the pump pit, no sediments were found, and water sample results did not indicate any elevated activity concentrations.

An FSS of the discharge channel has been performed. The results were presented to the regulators for their review and comment and issued as a final document. Based on all survey and sample results, the discharge channel meets release criteria for unrestricted use.

Due to the inaccessibility of the suction channel, no samples were collected. However, the wood decking in Drydock 3 was removed and replaced with new reinforced concrete slab flooring in 1952. Therefore, any residual radiological contamination from ships that participated in atomic weapons testing prior to 1952, which might have lodged in the porous wood structures and been released later, would have been removed.

Because the collector channel was designed with sand traps and grating to minimize sedimentation into the suction channel, any residual sediment would tend to be pushed through the suction channel, through the pumps, then through the discharge piping and the discharge channel and into the bay during the surge flow from dewatering operations. This surge flow occurred when the drydock was dewatered to allow workers to enter the drydock and place keel blocks to support the vessel during maintenance activities. The surge flow occurred again after the drydock had been flooded to allow entrance of the ship into the drydock and to leave the ship dry and supported on keel blocks for performance of maintenance activities.

Each dewatering event involved the transfer of 45 million gallons of water from the drydock through the suction channel and discharge piping and into the discharge channel in 2.5 hours. Assuming one ship per year required maintenance between 1946 (start of OPERATIONS CROSSROADS) and 1952 (when the wood decking had been replaced with a concrete floor), a total of 540 million gallons of water would have been transferred from the drydock through the suction channel and discharge piping and into the discharge channel. Assuming one ship per year required maintenance between 1953 and 1974 (when the DON closed HPS), a total of 1.89 billion gallons of water would have been transferred from the drydock through the suction channel and discharge piping and into the discharge channel.

It is unlikely that the nonporous cast iron discharge piping and concrete interior surface of the suction channel would have been radiologically impacted because any materials from ship decontamination efforts would have been transported rapidly during dewatering operations and deposited in the discharge channel as the most likely accumulation point for sediment. Any potential future human exposure to potentially impacted suction channel piping and sediment (if present at all) is very unlikely due to suction channel inaccessibility from its location at least 49 feet below the existing ground surface.

The maximum ^{137}Cs activity concentration in the sediment removed from the discharge channel prior to the FSS was 0.23 pCi/g. The global background soil ^{137}Cs activity concentration ranges from 0.3 to 3.0 pCi/g (Wallo et al. 1994). Additionally, mean concentrations of ^{137}Cs in drainage areas are typically three times that of non-drainage areas (Wallo et al. 1994). Thus, the activity concentration of 0.23 pCi/g may be attributed to global background soil ^{137}Cs activity concentrations and is not necessarily indicative of decontamination efforts from ships that participated in atomic weapons testing.

The maximum ^{137}Cs activity in the floating material collected in the discharge piping was 0.2043 pCi/g. Similar to the sediment present in the discharge channel, the activity concentration may be attributed to global background soil ^{137}Cs activity concentrations and is not necessarily indicative of decontamination efforts from ships that participated in atomic weapons testing.

The radiological remediation industry standard for determining both annual dose and risk is the RESRAD family of codes developed by Argonne National Laboratory. This software allows for input of numerous site-specific parameters to develop annual dose and/or risk outputs based on exposure pathways including external gamma, inhalation, plant ingestion, meat ingestion, milk ingestion, aquatic foods, drinking water, soil ingestion, and radon. Default parameters are automatically provided, but appropriate site-specific values may be input to best utilize the strength of the software for site-specific applications. If the maximum concentration of the sample in the discharge piping of 0.2043 pCi/g is modeled with all default parameters, and the discharge piping (1.2 meters by 22.5 meters) is assumed to be completely filled with soil/sediment at that activity concentration, RESRAD results in a maximum annual dose of 0.2596 mrem/y and a risk of 4.236×10^{-6} to an adult resident living in direct contact with the soil/sediment. These values are sufficiently less than the U.S. Environmental Protection Agency risk release limit for radiological concerns of 3×10^{-4} (nominally 15 mrem/y) (EPA 1997). The RESRAD data are provided in Attachment 3.

Based on the investigations, surveys, and data presented herein, Building 140 and its appurtenant structures present no threat to human health and the environment and can be released for unrestricted use. The DON is recommending unrestricted radiological release of Building 140, including the suction channel, pump pit, discharge piping, and discharge channel, as the surfaces of these components are free of residual radioactive contamination.

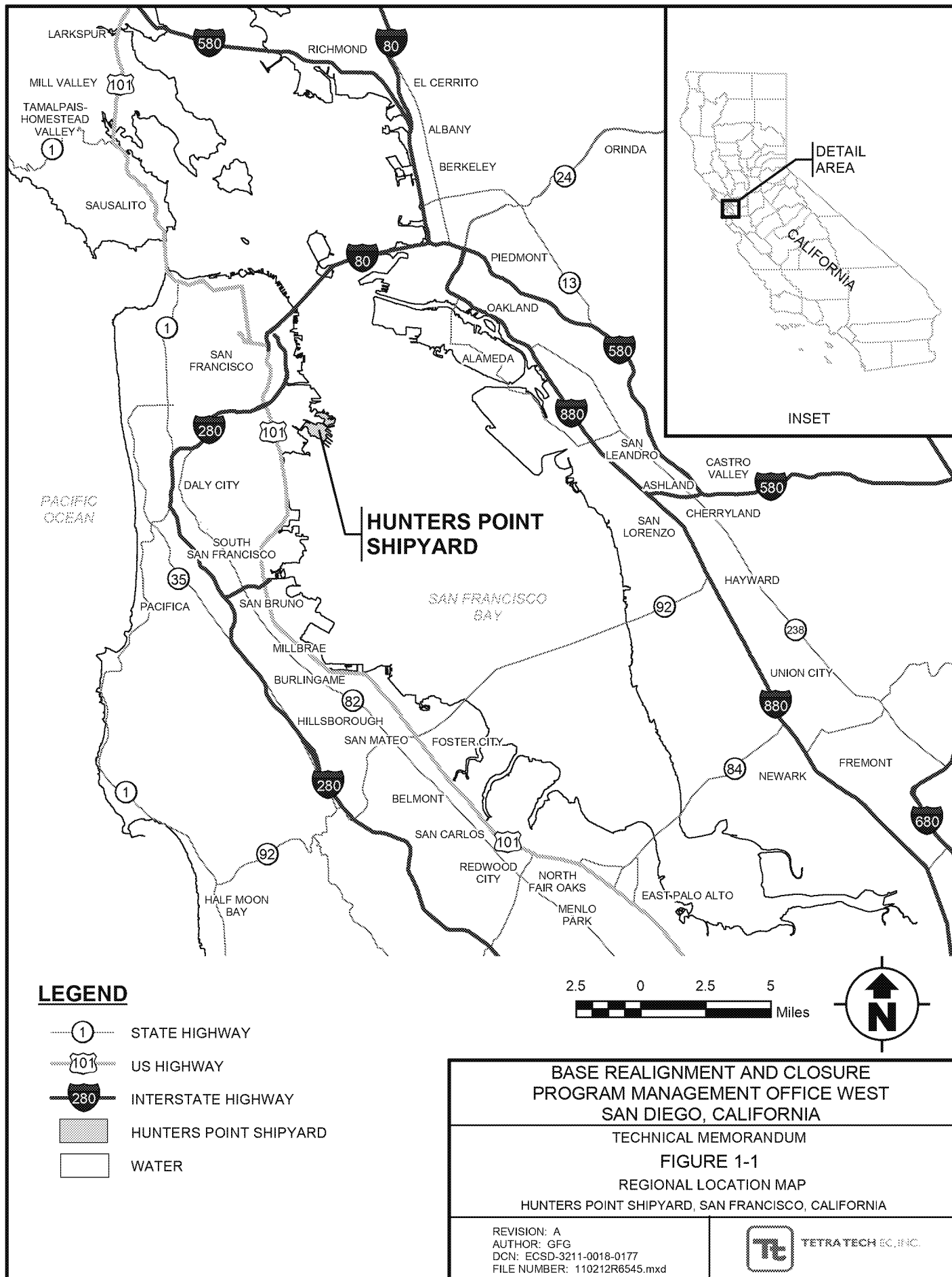
4.0 REFERENCES

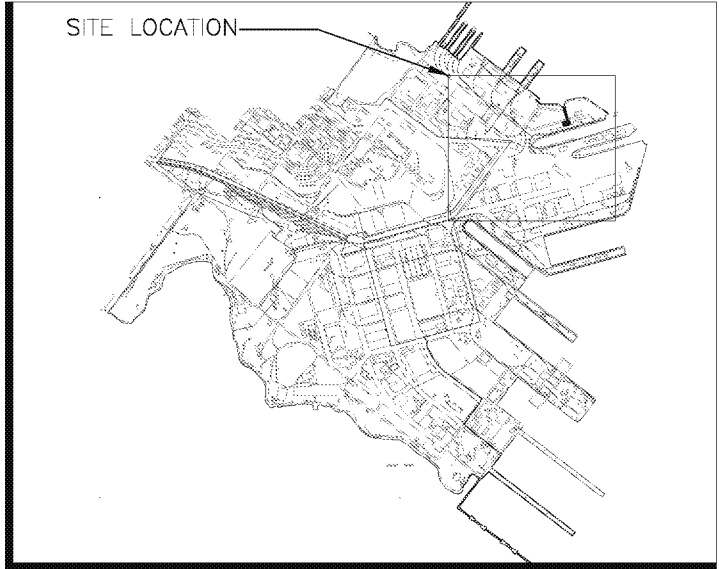
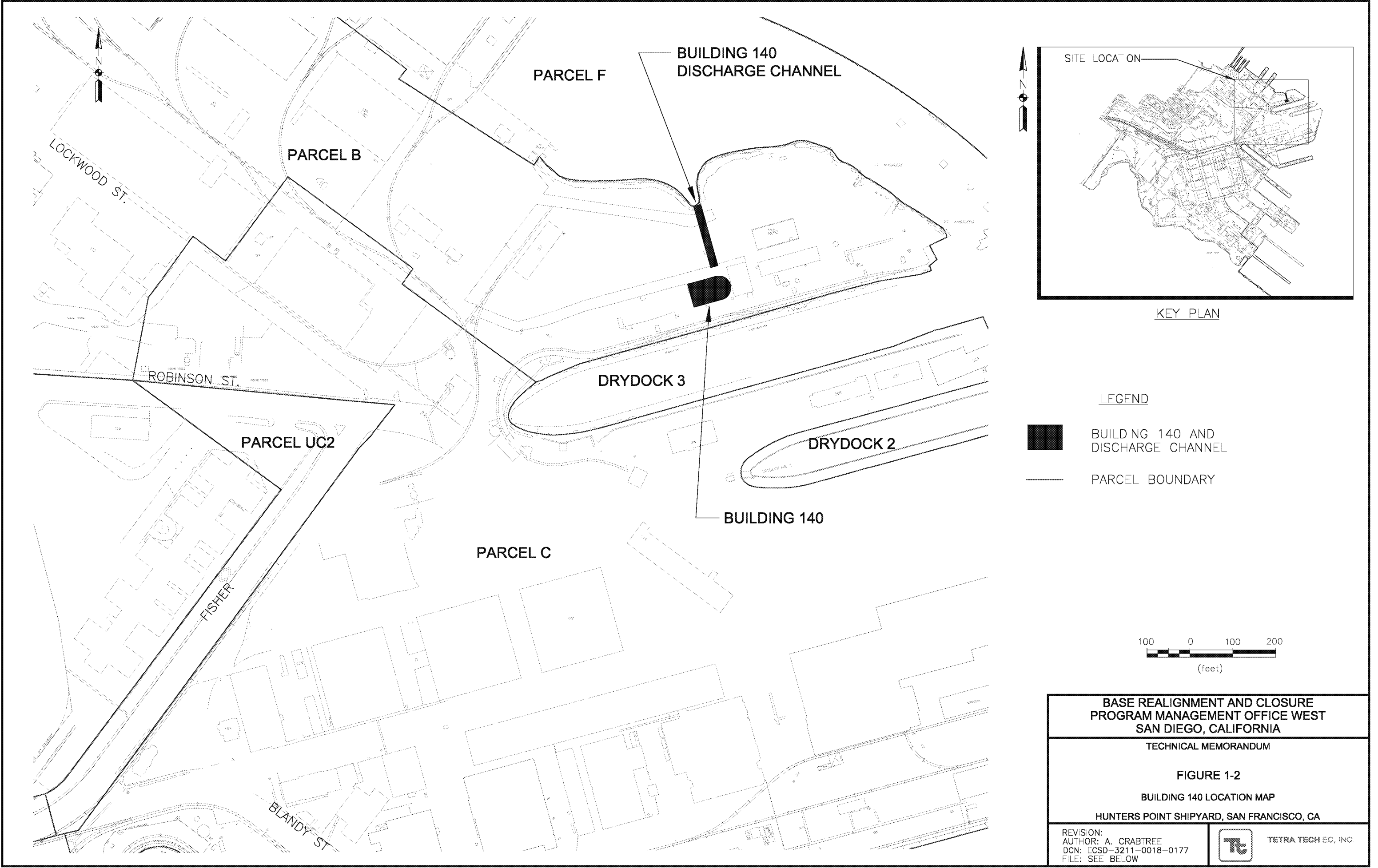
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- EPA (U.S. Environmental Protection Agency). 1997. OSWER 9200.4-18, Establishment of Clean Up Levels for CERCLA Sites with Radioactive Contamination. August 22.
- NAVSEA (Naval Sea Systems Command). 2004. Historical Radiological Assessment, Hunters Point Shipyard Annex, Volume II, History of the Uses of General Radioactive Material 1939–2003. August.
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FIGURES

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KEY PLAN

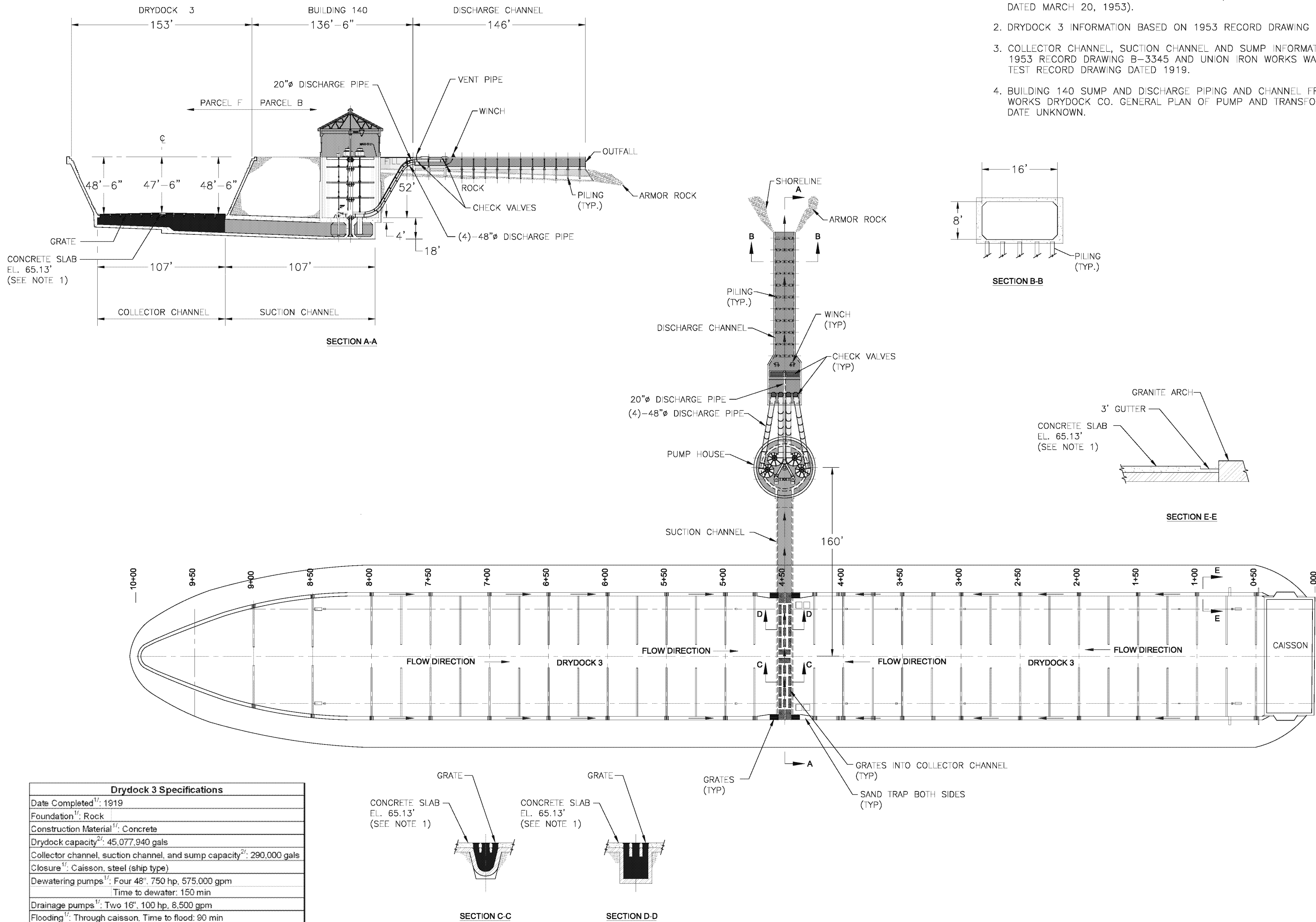
LEGEND

- BUILDING 140 AND DISCHARGE CHANNEL
- PARCEL BOUNDARY

<p>BASE REALIGNMENT AND CLOSURE PROGRAM MANAGEMENT OFFICE WEST SAN DIEGO, CALIFORNIA</p>	
<p>TECHNICAL MEMORANDUM</p>	
<p>FIGURE 1-2</p>	
<p>BUILDING 140 LOCATION MAP</p>	
<p>HUNTERS POINT SHIPYARD, SAN FRANCISCO, CA</p>	
<p>REVISION: AUTHOR: A. CRABTREE DCN: ECSD-3211-0018-0177 FILE: SEE BELOW</p>	<p>TETRA TECH EC, INC.</p>

NOTES:

1. WOOD DECKING, BILGEWAY, AND KEELSON REMOVED AND ENTIRE AREA OF DOCK WAS COVERED WITH NEW CONCRETE SLAB (SOURCE: RECORD DRAWING B-3343 DATED MARCH 20, 1953).
2. DRYDOCK 3 INFORMATION BASED ON 1953 RECORD DRAWING B-3345.
3. COLLECTOR CHANNEL, SUCTION CHANNEL AND SUMP INFORMATION BASED ON 1953 RECORD DRAWING B-3345 AND UNION IRON WORKS WATER CAPACITY/PUMPING TEST RECORD DRAWING DATED 1919.
4. BUILDING 140 SUMP AND DISCHARGE PIPING AND CHANNEL FROM UNION IRON WORKS DRYDOCK CO. GENERAL PLAN OF PUMP AND TRANSFORMER HOUSE, DATE UNKNOWN.



BUILDING 140 PUMP HOUSE, COLLECTOR, SUCTION & DISCHARGE CHANNELS
1/84" = 1'

BASE REALIGNMENT AND CLOSURE
PROGRAM MANAGEMENT OFFICE WEST
SAN DIEGO, CALIFORNIA

TECHNICAL MEMORANDUM

FIGURE 1-3

COLOR CODED MAP OF BUILDING 140 COMPONENTS
HUNTERS POINT SHIPYARD, SAN FRANCISCO, CA

REVISION:
AUTHOR: A. CRABTREE
DCN: ECSD-3211-0018-0177
FILE: SEE BELOW



TETRA TECH, INC.

ATTACHMENT 1

**MAY AND JUNE 2008 INITIAL BUILDING 140
INVESTIGATION DATA**

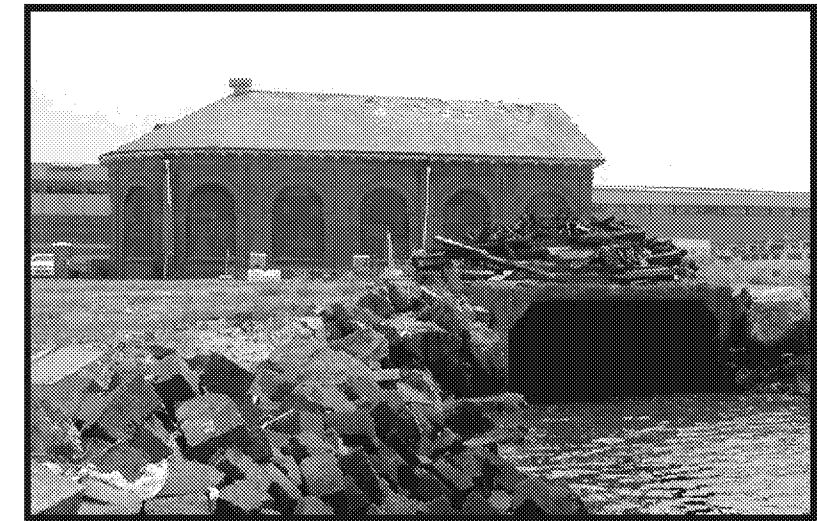
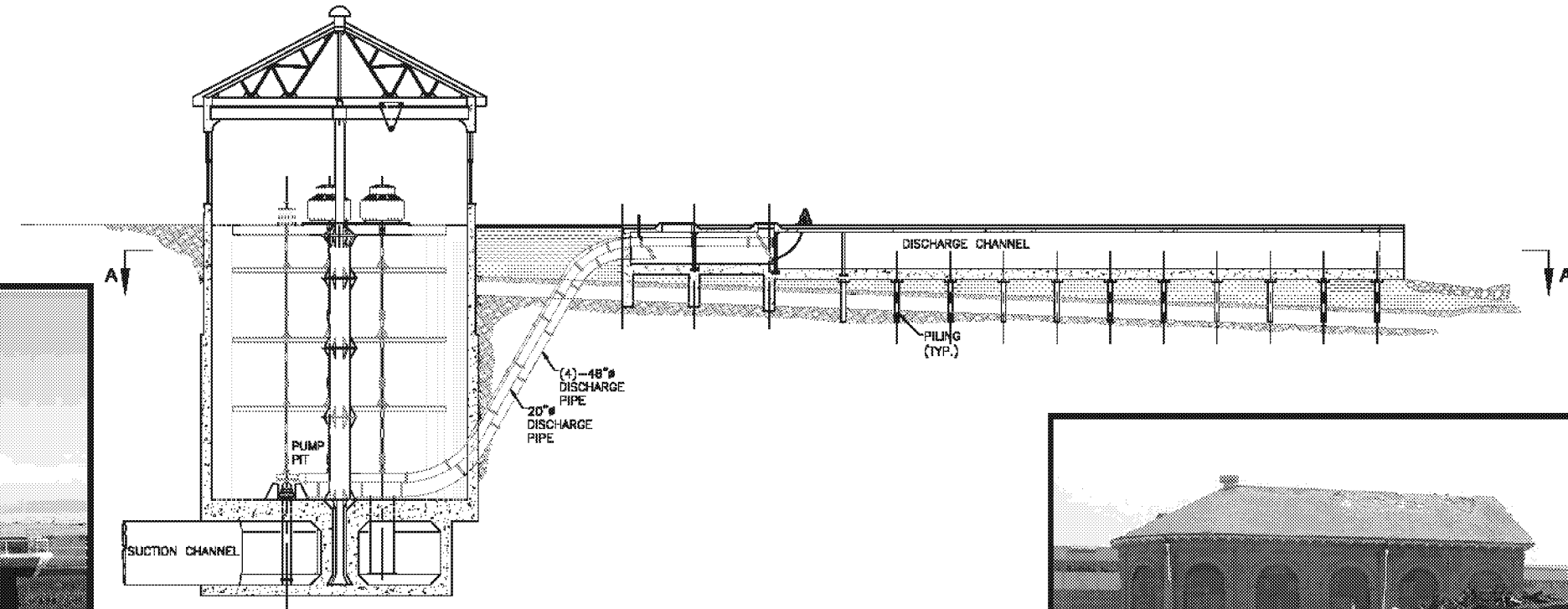
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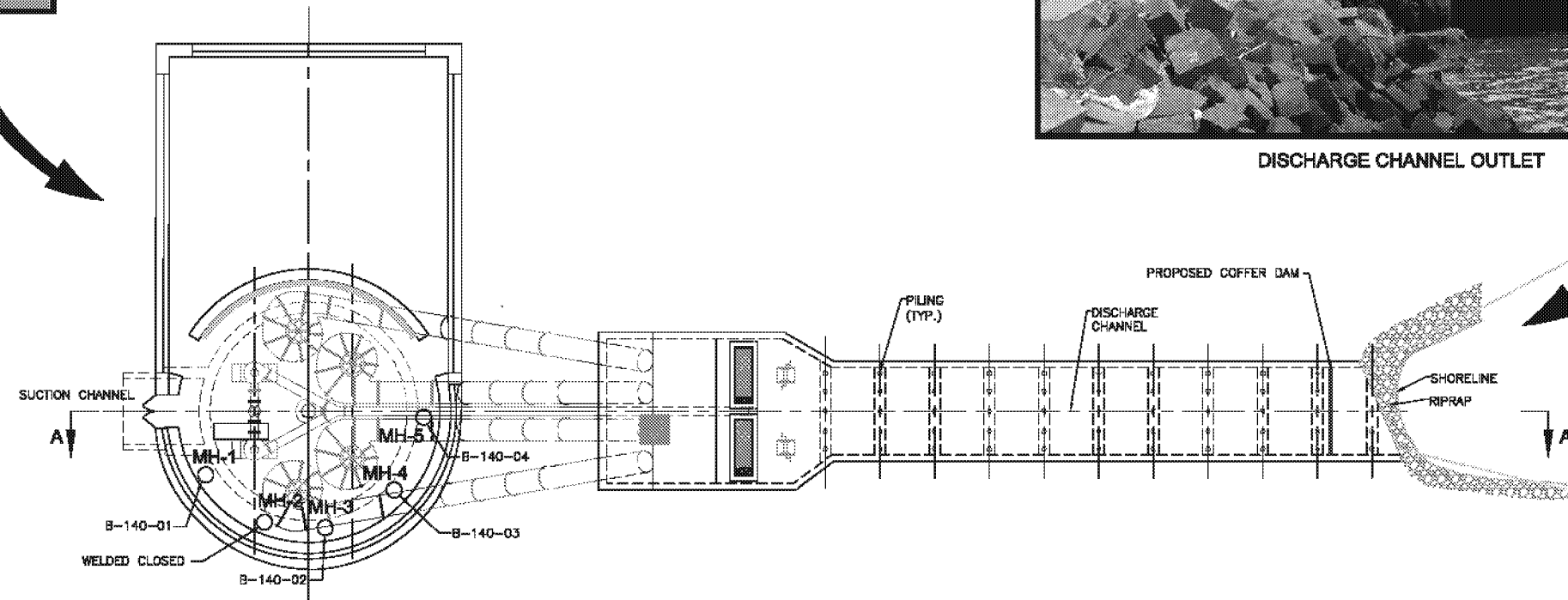
\\VEDI\PROJECTS\CTO-72X CAD FILES\BUILDING 140 PUMP HOUSE\DWG FILES\BD140-003_REV1.DWG
PLOT/UPDATE: APR 19 2011 14:04:43



DRYDOCK 3 AND BUILDING 140



DISCHARGE CHANNEL OUTLET



Building 140 Aqueous Sample Analytical Results					
Sample Location	Sample ID Number	R-226 pCi/ml		Cs-137 pCi/ml	
		Result	MDA	Result	MDA
MH-1	B-140-01	-0.198	0.965	0.0123	0.0311
MH-3	B-140-02	-0.756	0.858	0.0143	0.0178
MH-4	B-140-03	-0.257	0.787	0.0594	0.0292
MH-5	B-140-04	-0.387	0.918	0.0243	0.025

MDA = Minimum Detectable Activity

04-19-11

RESPONSIBLE ENGINEER	DRAWN BY	CHECKED BY	PROJECT ENGINEER	DATE	APPROV.
HUNTERS POINT SHIPYARD SAN FRANCISCO, CA P.O. BOX 884536, SAN FRANCISCO, CA 94188	A. CRUTCHER	A. CRUTCHER	TETRA TECH, INC. IN C 1230 COLUMBIA STREET, SUITE 750 SAN DIEGO, CA 92101 TEL (619) 231-0800 FAX (619) 234-0861	04-19-11	
HUNTERS POINT SHIPYARD PARCEL B BUILDING 140 FIGURE 2				KEY	DESCRIPTION
DRAWING NO. BD140-003				SHEET	OF
REVISION				A	

RADIATION/CONTAMINATION SURVEY FORM

Page 1 of 1

Date: 7/22/2008	Time: 09:00	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm ²)	Background + (dpm/100cm ²)
Survey Number: HPS-B140-INV-01								
Location: Building 140								
Surveyor: S. Rolfe								
Surveyor Signature:		2350-1 44-10	228706 242860	11/13/2008				7 Kcpm
Isotopes of Concern: ²³⁹ Pu ²²⁶ Ra ⁹⁰ Sr ¹³⁷ Cs								
		Description of drawing: Building 140 Investigative Survey 01						



Comments:

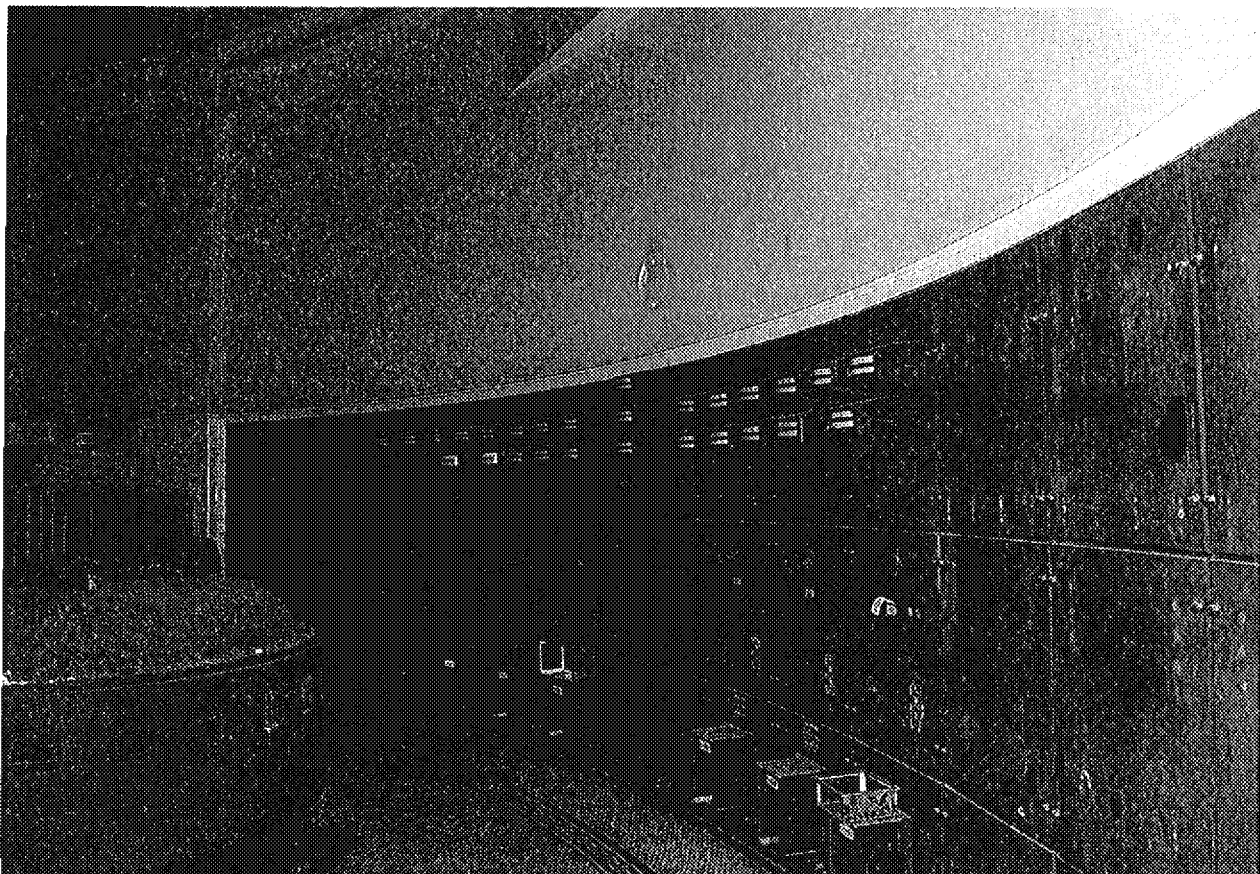
Gamma scans were performed with a 2350-1 instrument
Scan range of inner wall of the building: 7.8 - 11.4 Kcpm

- # denotes swipe location or fixed α/β readings
- # denotes G/A radiation readings
- # / # denotes contact / 1 meter radiation readings.
- * denotes highest radiation reading on contact
- LAW denotes large area masslinn wipe
- Δ denotes static location.
- * Unless Otherwise Noted
- All readings in μR/hr unless otherwise noted
- K = 1000

RADIATION/CONTAMINATION SURVEY FORM

Page 1 of 1

Date: 7/22/2008	Time: 09:40	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm2)	Background + (dpm/100cm2)
Survey Number: HPS-B140-INV-02								
Location: Building 140								
Surveyor: S. Rolfe								
Surveyor Signature:		2350-1 44-10	228706 242860	11/13/2008				7 Kcpm
Isotopes of Concern: ^{239}Pu ^{226}Ra ^{90}Sr ^{137}Cs								
Description of drawing: Building 140 Investigative Survey 02								



Comments:

Gamma scans were performed with a 2350-1 instrument
Scan range of electrical control panels: 12 - 15 Kcpm

- # denotes swipe location or fixed α/β readings
- # denotes G/A radiation readings
- #/# denotes contact / 1 meter radiation readings.
- * denotes highest radiation reading on contact
- LAW denotes large area masslinn wipe
- Δ denotes static location.
- + Unless Otherwise Noted
- All readings in $\mu\text{R/hr}$ unless otherwise noted
- K = 1000

RADIATION/CONTAMINATION SURVEY FORM

Page 1 of 1

Date: 7/22/2008	Time: 09:40	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm ²)	Background + (dpm/100cm ²)
Survey Number: HPS-B140-INV-03								
Location: Building 140								
Surveyor: S. Rolfe								
Surveyor Signature:		2350-1 44-10	228706 242860	11/13/2008				7 Kcpm
Isotopes of Concern: ²³⁹ Pu ²²⁶ Ra ⁹⁰ Sr ¹³⁷ Cs								
		Description of drawing: Building 140 Investigative Survey 03						

**Comments:**

Gamma scans were performed with a 2350-1 instrument

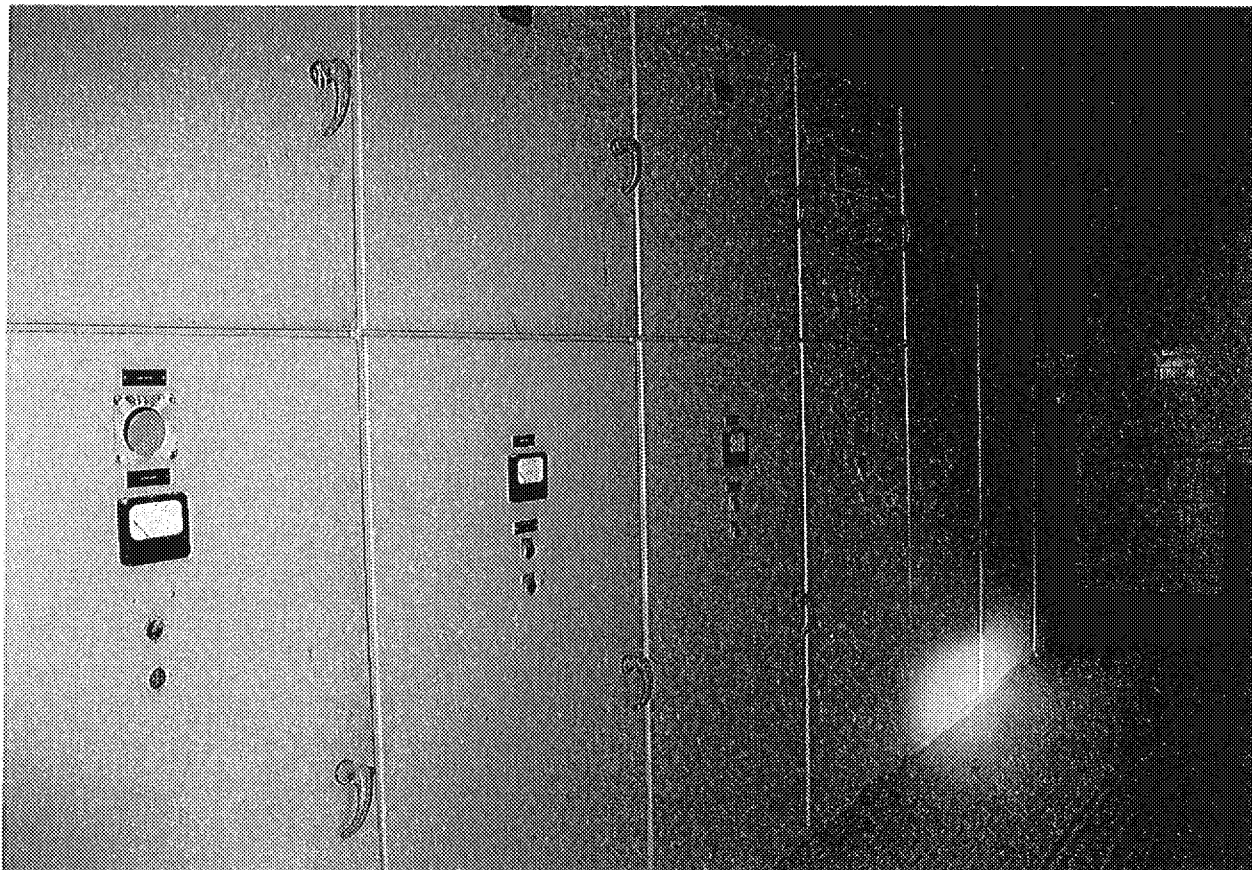
Scan range of electrical panels located in west end of the building: 6.9 - 12.8 Kcpm

- # denotes swipe location or fixed α/β readings
- # denotes G/A radiation readings
- # / # denotes contact / 1 meter radiation readings.
- * denotes highest radiation reading on contact
- LAW denotes large area masslinn wipe
- Δ denotes static location.
- + Unless Otherwise Noted
- All readings in μR/hr unless otherwise noted
- K = 1000

RADIATION/CONTAMINATION SURVEY FORM

Page 1 of 1

Date: 7/22/2008	Time: 09:40	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm2)	Background + (dpm/100cm2)
Survey Number: HPS-B140-INV-04								
Location: Building 140								
Surveyor: S. Rolfe								
Surveyor Signature:		2350-1 44-10	228706 242860	11/13/2008				7 Kcpm
Isotopes of Concern: ^{239}Pu ^{226}Ra ^{90}Sr ^{137}Cs								
		Description of drawing: Building 140 Investigative Survey 04						



Comments:

Gamma scans were performed with a 2350-1 instrument
 Scan range of electrical panels located in center of the building: 12.5 - 15.5 Kcpm

- # denotes swipe location or fixed α/β readings
- denotes G/A radiation readings
- denotes contact / 1 meter radiation readings.
- * denotes highest radiation reading on contact
- LAW denotes large area masslinn wipe
- Δ denotes static location.
- + Unless Otherwise Noted
- All readings in $\mu\text{R/hr}$ unless otherwise noted
- K = 1000

ORTEC g v - i (3263) wan32 G53W2.10 15-AUG-2008 14:16:04
New world technology Spectrum name: 3N000810.An1

Sample description
Parcel B 72AB140-001 211ml
5/19/08 11:45

Acquisition information

Start time: 14-Aug-2008 14:24:39
Live time: 2700
Real time: 2702

***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****
Time of Count Uncertainty 2 Sigma
Nuclide Activity Counting Total MDA
pCi/ml pCi/ml pCi/ml pCi/ml

Ac-228 #B	1.0127E-01	1.0091E-01	1.0110E-01	0.299E+00
Am-241 #B	4.0025E-02	5.7812E-01	5.7813E-01	0.138E+00
Bi-212 B	7.6551E-02	4.8993E-01	4.8996E-01	0.458E+00
Bi-214 F	5.5059E-01	9.6599E-01	9.6657E-01	0.119E+00
Co-60 #B	2.6349E-02	2.1416E-01	2.1417E-01	0.148E+00
CS-137 B	1.2358E-02	4.0665E-02	4.0672E-02	0.311E-01
Eu-152 #B	4.2511E-02	8.5022E-02	8.5075E-02	0.547E-01
Eu-154 F	1.2993E-01	1.3307E-01	1.3338E-01	0.246E-01
K-40 #B	3.0303E+00	6.6421E+00	6.6448E+00	0.391E+01
Pa-234 F	1.3831E-01	2.8609E-01	2.8628E-01	0.787E-01
Pb-210 #B	8.7340E-01	2.5177E+00	2.5186E+00	0.101E+01
Pb-212 #B	1.3070E-01	3.0956E-01	3.0967E-01	0.109E+00
Pb-214 B	1.5037E-01	1.8002E-01	1.8027E-01	0.145E+00
RA-226 #B	1.9870E-01	1.2502E+00	1.2503E+00	0.965E+00
Th-230 #B	2.8631E+02	5.0700E+02	5.0843E+02	0.260E+02
Th-234 #B	1.7000E+01	3.8414E+01	3.8457E+01	0.204E+01
Pt-208 #F	4.2810E-01	1.2435E-01	1.2703E-01	0.529E-01
U-235 B	2.2344E-02	7.0327E-02	7.0341E-02	0.564E-01

- All peaks for activity calculation had bad shape.
* - Activity omitted from total
& - Activity omitted from total and all peaks had bad shape.
< - MDA value printed.
A - Activity printed, but activity < MDA.
B - Activity < MDA and failed test.
C - Area < Critical level.
F - Failed fraction or key line test.
H - Half-life limit exceeded

S U M M A R Y
Total Activity (39.0 to 2490.0 keV) 0.000E+00 pCi/ml

Laboratory: New World Technology

ORTEC g v - i (3263) wan32 G53w2.06 15-AUG-2008 08:00:28
New World Technology Spectrum name: 5N000865.An1

Sample description
Parcel B 72AB140-002 281ml
5/19/08 13:20

Acquisition information
Start time: 14-Aug-2008 14:30:36
Live time: 2700
Real time: 2703

```
***** S U M M A R Y   O F   N U C L I D E S   I N   S A M P L E   *****
Nuclide   Time of Count   Uncertainty   2 Sigma
          Activity       Counting      Total
          pCi/ml        pCi/ml        pCi/ml        MDA
                      pCi/ml        pCi/ml
-----
AC-228 #B  -4.8553E-01  -8.3121E+00  -8.3122E+00  0.213E+00
AM-241 #B  -8.3515E-02  -4.0690E-01  -4.0691E-01  0.977E-01
Bi-212 B   2.3104E-02   2.8226E-01   2.8227E-01   0.235E+00
BI-214 #F   1.3275E-01   8.6381E-02   8.6521E-02   0.983E-01
CO-60 #B   4.9957E-03   1.1551E-02   1.1552E-02   0.228E-01
CS-137 #B   1.4319E-02   2.7032E-02   2.7037E-02   0.178E-01
EU-152 F    1.0889E-01   9.5501E-02   9.5586E-02   0.801E-01
EU-154 F    5.9827E-02   8.4653E-02   8.4682E-02   0.560E-01
K-40 #      3.5695E+00   1.0898E+00   1.0978E+00   0.735E+00
Pa-234 F    1.5628E-01   9.9955E-02   1.0012E-01   0.734E-01
Pb-210 B    6.3780E-01   9.0263E-01   9.0293E-01   0.779E+00
Pb-212 B   -5.6910E-02  -1.1173E-01  -1.1175E-01   0.100E+00
PB-214 #F    1.1618E-01   1.4905E-01   1.4911E-01   0.996E-01
RA-226 #B   -7.5639E-01  -3.3002E+00  -3.3003E+00   0.858E+00
Th-230 #B   -1.0527E+01  -4.4336E+01  -4.4338E+01   0.803E+01
Th-234 B    2.8312E-01   2.2571E-01   2.2595E-01   0.784E+00
Tl-208 #B   -1.7362E-01   2.5919E+02   2.5919E+02   0.981E-01
U-235 #B   -1.1378E+00   2.8919E+02   2.8919E+02   0.125E+00
```

- All peaks for activity calculation had bad shape.
* - Activity omitted from total
& - Activity omitted from total and all peaks had bad shape.
< - MDA value printed.
A - Activity printed, but activity < MDA.
B - Activity < MDA and failed test.
C - Area < Critical level.
F - Failed fraction or key line test.
H - Half-life limit exceeded

```
----- S U M M A R Y -----
Total Activity ( 41.3 to 2632.8 keV) 3.5695362E+00 pCi/ml
```

Laboratory: New World Technology

ORTEC g v - i (3263) wan32 G53w2.06 14-AUG-2008 14:26:54
New World Technology Spectrum name: 5N000864.An1

Sample description
Parcel B 72AB140-003 287ml
5/19/08 13:25

Acquisition information

Start time: 14-Aug-2008 13:04:01
Live time: 2700
Real time: 2704

***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****
Time of Count Uncertainty 2 Sigma
Nuclide Activity Counting Total MDA
pCi/ml pCi/ml pCi/ml pCi/ml

Ac-228 #B	-4.1774E-01	-8.9876E-01	-8.9890E-01	0.193E+00
AM-241 #B	-1.2013E-01	-1.3614E+00	-1.3614E+00	0.981E-01
Bi-212 #B	-3.6609E-02	7.4430E+02	7.4430E+02	0.282E+00
BI-214 #F	7.3813E-02	5.0730E-02	5.0804E-02	0.449E-01
CO-60 #F	7.4806E-02	5.2686E-02	5.2759E-02	0.268E-01
CS-137	5.9408E-02	4.5944E-02	4.5996E-02	0.292E-01
EU-152 #B	-3.3364E-04	-7.4604E-04	-7.4614E-04	0.574E-01
EU-154 F	2.1092E-01	8.7961E-02	8.8306E-02	0.492E-01
K-40 #	5.4169E+00	1.0834E+00	1.1019E+00	0.126E+00
Pa-234 B	2.5772E-02	6.5771E-02	6.5778E-02	0.812E-01
Pb-210 F	7.9120E-01	1.0565E+00	1.0569E+00	0.746E+00
Pb-212 #B	-8.5623E-02	-1.5025E-01	-1.5028E-01	0.898E-01
PB-214 B	-2.5181E-02	-3.4085E-02	-3.4098E-02	0.106E+00
RA-226 #B	-2.5734E-01	-1.3712E+00	-1.3712E+00	0.787E+00
Th-230 #B	-8.4028E+00	-3.5610E+01	-3.5611E+01	0.803E+01
Th-234 B	2.6600E-01	1.7522E-01	1.7549E-01	0.760E+00
Tl-208 B	6.0837E-03	2.4337E-03	2.4442E-03	0.960E-01
U-235 #B	-1.1140E+00	2.8095E+02	2.8095E+02	0.121E+00

- All peaks for activity calculation had bad shape.
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< - MDA value printed.
A - Activity printed, but activity < MDA.
B - Activity < MDA and failed test.
C - Area < Critical level.
F - Failed fraction or key line test.
H - Halflife limit exceeded

----- S U M M A R Y -----
Total Activity (41.3 to 2632.8 keV) 5.5510864E+00 pCi/ml

Laboratory: New World Technology

ORTEC g v - i (3263) wan32 G53W2.06 14-AUG-2008 14:43:17
New World Technology Spectrum name: 7N000888.An1

Sample description
Parcel B 72AB140-004 281ml
5/19/08 13:30

Acquisition information

Start time: 14-Aug-2008 13:19:50
Live time: 2700
Real time: 2701

***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****
Nuclide Time of Count Uncertainty 3 Sigma
Activity Counting Total
pCi/ml pCi/ml pCi/ml MDA
pCi/ml

AC-228 #F	5.1821E-01	2.5687E-01	2.5849E-01	0.624E-01
AM-241 #B	-5.8434E-02	-2.9661E+00	-2.9661E+00	0.657E-01
BI-212 #F	3.6629E-01	5.6268E-01	5.6305E-01	0.238E+00
BI-214 F	2.4552E-01	1.4501E-01	1.4565E-01	0.560E-01
CO-60 #F	5.5330E-02	6.9205E-02	6.9274E-02	0.391E-01
CS-137 B	2.4322E-02	5.2749E-02	5.2766E-02	0.250E-01
EU-152 #B	-3.2793E-03	-5.0288E-03	-5.0321E-03	0.993E-01
EU-154 F	1.9247E-01	1.5507E-01	1.5544E-01	0.552E-01
K-40	4.2067E+00	1.5947E+00	1.6119E+00	0.614E+00
PA-234 #F	2.0205E-01	1.5605E-01	1.5646E-01	0.462E-01
PB-210 F	8.5890E-01	1.3640E+00	1.3648E+00	0.753E+00
PB-212 F	1.0082E-01	1.2779E-01	1.2791E-01	0.666E-01
PB-214 B	5.4617E-02	1.0393E-01	1.0397E-01	0.102E+00
RA-226 #B	-3.8676E-01	-2.8574E+00	-2.8575E+00	0.918E+00
Th-230 #B	-2.1693E+01	-2.1875E+02	-2.1875E+02	0.561E+01
TH-234 B	4.6684E-01	1.3147E+00	1.3150E+00	0.722E+00
TL-208 #B	2.6229E-02	2.5424E-02	2.5466E-02	0.428E-01
U-235 #B	-9.6864E-01	-1.3937E+01	-1.3937E+01	0.113E+00

- All peaks for activity calculation had bad shape.
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& - Activity omitted from total and all peaks had bad shape.
< - MDA value printed.
A - Activity printed, but activity < MDA.
B - Activity < MDA and failed test.
C - Area < Critical level.
F - Failed fraction or key line test.
H - Half-life limit exceeded

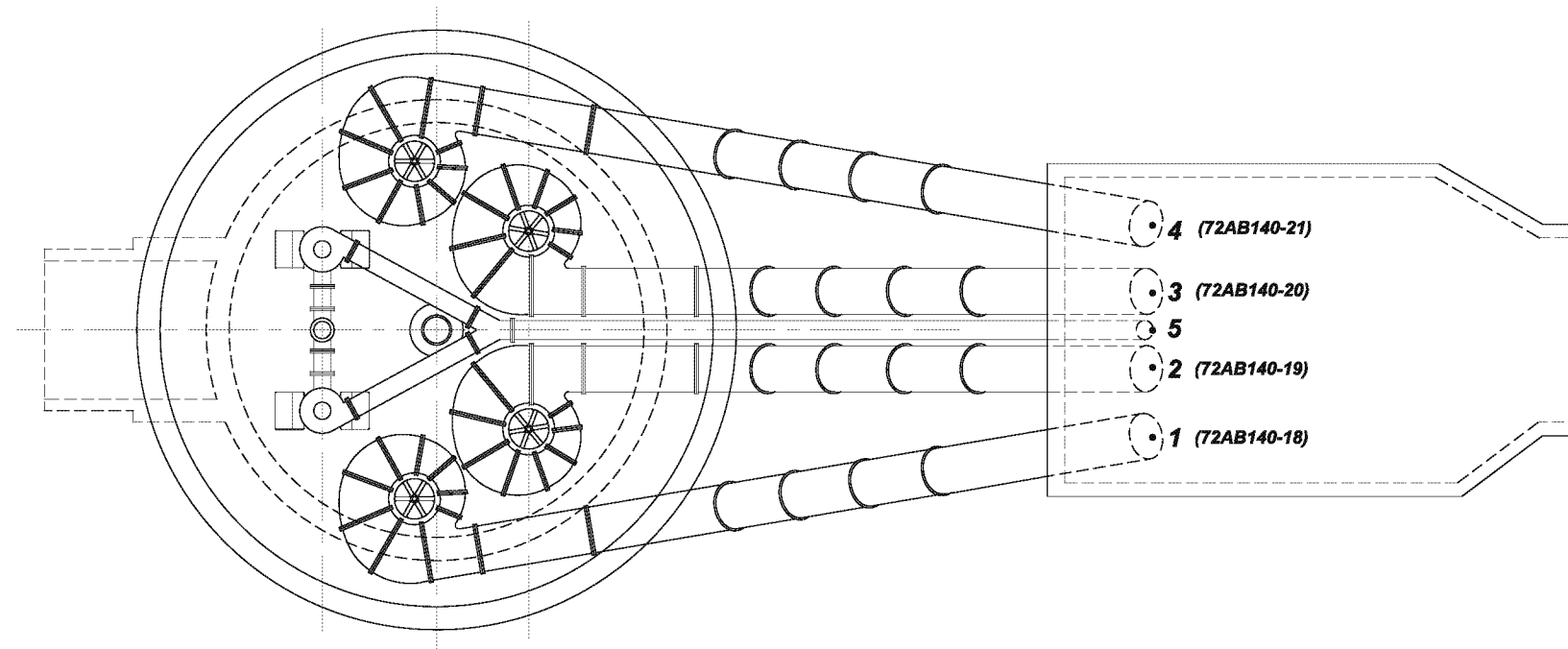
----- S U M M A R Y -----
Total Activity (41.9 to 2667.9 keV) 5.0735745E+00 pCi/ml

Laboratory: New World Technology

ATTACHMENT 2

JULY 2009 DISCHARGE PIPING SAMPLE DATA

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BUILDING 140 PUMP HOUSE DISCHARGE CHANNEL PLAN VIEW
1/8" = 1'

LEGEND
PIPE #
• 1 (72AB140-013)
SAMPLE ID

Building 140 Discharge Pipe Sampling					
Sample		Sample Analytical Results			
		Ra-226 pCi/g		Cs-137 pCi/g	
Location	ID Number	Result	Release Limit	Result	Release Limit
Pipe # 1	72AB140-18	0.9186	1.485	0.0605	0.113
Pipe # 2	72AB140-19	0.8973	1.485	0.0802	0.113
Pipe # 3	72AB140-20	0.8661	1.485	0.0706	0.113
Pipe # 4	72AB140-21	0.5709	1.485	0.2043	0.113

elevated readings

NOTE: NO SEDIMENT PRESENT IN PIPE #5.

BASE REALIGNMENT AND CLOSURE
PROGRAM MANAGEMENT OFFICE WEST
SAN DIEGO, CALIFORNIA

BUILDING 140 DISCHARGE PIPING

RESULTS FOR SEDIMENT SAMPLES

HUNTERS POINT SHIPYARD, SAN FRANCISCO, CA.

REVISION:
AUTHOR: A. CRABTREE
PROJECT NO:
FILE: SEE BELOW



TETRA TECH EC, INC.

ORTEC g v - i (3263) Npp32 G53W3.10 13-JUL-2009 10:11:09
New World Technology Spectrum name: 1N001241.An1

Sample description
Parcel B 72AB140-018 318g
7/10/09 12:45

Acquisition information

Start time: 13-Jul-2009 09:26:01
Live time: 2700
Real time: 2701

***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****

Nuclide	Time of Count	Uncertainty	2 Sigma	MDA
	Activity	Counting	Total	pCi/g
	pCi/g	pCi/g	pCi/g	
Ac-228 B	5.8031E-02	4.8970E-02	4.9101E-02	0.149E+00
AM-241 #A	-9.5952E-03	1.3214E-01	1.3214E-01	0.306E-01
Bi-212 #B	-3.3543E-01	1.3417E+01	1.3417E+01	0.298E+00
Bi-214 F	1.6024E-01	7.6606E-02	7.7206E-02	0.386E-01
CO-60 #B	-1.1280E-03	4.5119E-02	4.5119E-02	0.973E-02
CS-137	6.0544E-02	3.7808E-02	3.7985E-02	0.211E-01
EU-152 #C	1.1512E-01	6.4804E-02	6.5296E-02	0.409E-01
EU-154 #A	-5.1718E-03	1.3354E-02	1.3358E-02	0.335E-01
K-40 #	2.2095E+00	6.4143E-01	6.5596E-01	0.108E+00
Pa-234 #F	1.2003E-01	6.9753E-02	7.0314E-02	0.468E-01
Pb-210 #F	7.7324E-01	1.0063E+00	1.0073E+00	0.633E+00
Pb-212 F	1.0097E-01	7.8564E-02	7.8828E-02	0.592E-01
Pb-214 F	1.6378E-01	9.9090E-02	9.9604E-02	0.489E-01
RA-226 F	9.1863E-01	9.5623E-01	9.5803E-01	0.760E+00
Th-230 #B	-8.7158E+00	7.0701E+01	7.0710E+01	0.407E+01
Th-234 F	7.6551E-01	7.9949E-01	8.0299E-01	0.638E+00
Tl-208 #F	5.8006E-02	2.9577E-02	2.9780E-02	0.956E-02
U-235 B	1.3330E-01	5.4140E-02	5.4877E-02	0.203E+00

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A - Activity printed, but activity < MDA.
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C - Area < Critical level.
F - Failed fraction or key line test.
H - Half-life limit exceeded

----- S U M M A R Y -----
Total Activity (39.4 to 2490.5 keV) 2.873E+00 pCi/g

Laboratory: New World Technology

ORTEC g v - i (3263) Npp32 G53W3.10 15-JUL-2009 10:43:57
New World Technology Spectrum name: 6N001021.An1

Sample description
Parcel B 72AB140-019 232g
7/13/09 13:00

Acquisition information

Start time: 15-Jul-2009 09:11:31
Live time: 5400
Real time: 5409

***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****
Time of Count Uncertainty 2 Sigma
Nuclide Activity Counting Total MDA
pci/g pci/g pci/g pci/g

Ac-228	F	4.0072E-01	1.8191E-01	1.8358E-01	0.157E+00
AM-241	#A	1.6140E-02	1.0149E-01	1.0149E-01	0.745E-01
Bi-212	F	6.4402E-01	3.6031E-01	3.6244E-01	0.247E+00
BI-214		3.9947E-01	1.3237E-01	1.3452E-01	0.771E-01
CO-60	#B	1.0292E-02	2.6462E-02	2.6470E-02	0.189E-01
CS-137		8.0217E-02	5.3768E-02	5.3985E-02	0.388E-01
EU-152	F	1.2992E-01	1.1898E-01	1.1932E-01	0.842E-01
EU-154	F	1.0356E-01	7.0752E-02	7.1116E-02	0.548E-01
K-40		1.2365E+01	1.2894E+00	1.4997E+00	0.293E+00
Pa-234	#F	1.8762E-01	1.6989E-01	1.7045E-01	0.978E-01
Pb-210	B	4.5855E-02	8.8491E-01	8.8492E-01	0.783E+00
Pb-212	F	3.2811E-01	9.0989E-02	9.3370E-02	0.716E-01
PB-214	F	3.7453E-01	1.3946E-01	1.4137E-01	0.721E-01
RA-226	F	8.9731E-01	9.7805E-01	9.7972E-01	0.793E+00
Th-230	#B	-2.4736E+00	1.6533E+02	1.6533E+02	0.450E+01
Th-234	B	6.0722E-01	2.8455E-01	2.9069E-01	0.824E+00
Tl-208	#F	3.6672E-01	8.9858E-02	1.0115E-01	0.138E-01
U-235	F	1.1225E-01	7.8436E-02	7.8763E-02	0.542E-01

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C - Area < Critical level.
F - Failed fraction or key line test.
H - Halflife limit exceeded

----- S U M M A R Y -----
Total Activity (33.3 to 2659.0 kev) 1.526E+01 pci/g

Laboratory: New World Technology

ORTEC g v - i (3263) Npp32 G53W3.10 20-JUL-2009 09:20:34
New World Technology Spectrum name: 3N001284.An1

Sample description
Parcel B 72AB140-020 254g
7/14/09 13:30

Acquisition information

Start time: 20-Jul-2009 08:08:07
Live time: 2700
Real time: 2704

***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****

Nuclide		Time of Count Activity pci/g	Uncertainty Counting pci/g	2 Sigma Total pci/g	MDA pCi/g
Ac-228	F	6.3176E-01	2.5889E-01	2.6180E-01	0.231E+00
AM-241	#B	4.9775E-02	1.7329E-01	1.7332E-01	0.114E+00
Bi-212	B	9.8466E-02	2.8603E-01	2.8610E-01	0.247E+00
BI-214	F	3.3422E-01	1.5431E-01	1.5560E-01	0.747E-01
CO-60	#B	-4.7717E-03	3.3710E-02	3.3711E-02	0.308E-01
CS-137		7.0595E-02	6.4942E-02	6.5082E-02	0.463E-01
EU-152	#B	1.1954E-02	3.5330E-02	3.5340E-02	0.118E+00
EU-154	F	1.4949E-01	7.5415E-02	7.6125E-02	0.828E-01
K-40		1.1010E+01	1.7197E+00	1.8500E+00	0.156E+00
Pa-234	B	7.4688E-02	8.4339E-02	8.4519E-02	0.107E+00
Pb-210	#	2.4656E+00	1.5191E+00	1.5256E+00	0.934E+00
Pb-212	F	4.2660E-01	1.3215E-01	1.3492E-01	0.927E-01
PB-214	F	4.2089E-01	1.8806E-01	1.8984E-01	0.104E+00
RA-226	B	8.6608E-01	1.3011E+00	1.3023E+00	0.106E+01
Th-230	#B	-1.2435E+01	5.3401E+01	5.3424E+01	0.873E+01
Th-234	F	1.0077E+00	7.7416E-01	7.8042E-01	0.989E+00
Tl-208	F	2.1064E-01	1.2952E-01	1.3013E-01	0.516E-01
U-235	F	1.1261E-01	8.4064E-02	8.4372E-02	0.629E-01

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C - Area < Critical level.
F - Failed fraction or key line test.
H - Half-life limit exceeded

----- S U M M A R Y -----
Total Activity (39.2 to 2494.4 keV) 1.505E+01 pci/g

Laboratory: New World Technology

ORTEC g v - i (3263) Npp32 G53W3.10 20-JUL-2009 13:05:51
New World Technology Spectrum name: 3N001285.An1

Sample description
Parcel B 72AB140-021 280g
7/15/09 13:30

Acquisition information

Start time: 20-Jul-2009 10:54:06
Live time: 5400
Real time: 5409

***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****

Nuclide		Time of Count	Uncertainty	2 Sigma	MDA pCi/g
		Activity pCi/g	Counting pCi/g	Total pCi/g	
Ac-228	F	8.4080E-01	2.5787E-01	2.6302E-01	0.120E+00
AM-241	#B	3.7506E-02	1.4832E-01	1.4834E-01	0.907E-01
Bi-212	F	5.5981E-01	3.1294E-01	3.1480E-01	0.288E+00
Bi-214	F	3.6950E-01	1.2740E-01	1.2931E-01	0.662E-01
CO-60	#B	-7.9293E-03	1.8771E-02	1.8778E-02	0.222E-01
CS-137		2.0431E-01	5.9507E-02	6.0772E-02	0.364E-01
EU-152	F	2.0882E-01	1.1865E-01	1.1953E-01	0.617E-01
EU-154	#F	1.0201E-01	6.5870E-02	6.6249E-02	0.576E-01
K-40		1.5440E+01	1.3716E+00	1.6721E+00	0.710E-01
Pa-234	#F	1.4578E-01	9.7896E-02	9.8486E-02	0.991E-01
Pb-210	#B	-2.1510E-01	1.8743E+00	1.8743E+00	0.767E+00
Pb-212	F	6.1371E-01	9.8610E-02	1.0611E-01	0.656E-01
PB-214	F	6.1106E-01	1.3156E-01	1.3686E-01	0.734E-01
RA-226	B	5.7093E-01	8.3296E-01	8.3376E-01	0.683E+00
Th-230	#B	-1.0130E+01	4.2699E+01	4.2718E+01	0.696E+01
Th-234		1.8358E+00	7.6624E-01	7.8702E-01	0.657E+00
Tl-208	F	3.1048E-01	8.0803E-02	8.2902E-02	0.324E-01
U-235	F	8.4275E-02	5.5959E-02	5.6217E-02	0.430E-01

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F - Failed fraction or key line test.
H - Half-life limit exceeded

----- S U M M A R Y -----
Total Activity (39.2 to 2494.4 keV) 2.046E+01 pCi/g

Laboratory: New World Technology

ENTERED 

[illegible]



TestAmerica Laboratories, Inc.

ANALYTICAL REPORT

PROJECT NO. CT072X

HPS Projects

Lot #: F9I030195

Lisa Bienkowski

Tetra Tech EC, Inc.
1230 Columbia Street
Suite 750
San Diego, CA 92101

TESTAMERICA LABORATORIES, INC.

A handwritten signature in black ink, appearing to read "Ivan Vania", is positioned above the printed name and title.

Ivan Vania
Project Manager

September 15, 2009

Case Narrative
LOT NUMBER: F9I030195

This report contains the analytical results for the sample received under chain of custody by TestAmerica St. Louis on September 3, 2009. This sample is associated with your HPS Projects project.

The analytical results included in this report meet all applicable quality control procedure requirements.

The test results in this report meet all NELAP requirements for parameters in which accreditations are held by TestAmerica St. Louis. Any exceptions to NELAP requirements are noted in the case narrative. **TestAmerica St. Louis' Florida certification number is E87689.** The case narrative is an integral part of this report.

This report shall not be reproduced, except in full, without the written approval of the laboratory.

All chemical analysis results are based upon sample as received, wet weight, unless noted otherwise. Ra-226 analysis by gamma spectroscopy is performed on an as-received basis unless sample containers were received cracked or broken. Analysis parameters for cracked or broken samples will be listed in the narrative.

Ra-226 results analyzed by method EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

Observations/Nonconformances

Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt.

There were no nonconformances or observations noted with any analysis on this lot.

METHODS SUMMARY**F9I030195**

<u>PARAMETER</u>	<u>ANALYTICAL METHOD</u>	<u>PREPARATION METHOD</u>
Isotopic Plutonium by Alpha Spectroscopy	EML A-01-R	
Total Strontium By GFPC	EPA 905 MOD	

References:

EML "ENVIRONMENTAL MEASUREMENTS LABORATORY PROCEDURES MANUAL"
HASL-300 28TH EDITION, VOLUME I and II DEPARTMENT OF ENERGY

EPA "EASTERN ENVIRONMENTAL RADIATION FACILITY RADIOCHEMISTRY
PROCEDURES MANUAL" US EPA EPA 520/5-84-006 AUGUST 1984

SAMPLE SUMMARY**F9I030195**

<u>WO #</u>	<u>SAMPLE#</u>	<u>CLIENT SAMPLE ID</u>	<u>SAMPLED DATE</u>	<u>SAMP TIME</u>
LJ9RD	001	72AB140-021	07/15/09	13:30

NOTE(S) :

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

Tetra Tech EC, Inc.

Client Sample ID: 72AB140-021

Radiochemistry

Lab Sample ID: F9I030195-001
 Work Order: LJ9RD
 Matrix: SOLID

Date Collected: 07/15/09 1330
 Date Received: 09/03/09 0920

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Total SR BY GFPC	EPA-905 MOD			pCi/g		Batch # 9246456		Yld % 78
Strontium Total	0.17	J	0.15	0.32	0.14	200	09/03/09	09/09/09
Iso PLUTONIUM (SHORT CT)	DOE A-01-R MOD			pCi/g		Batch # 9248060		Yld % 96
Plutonium 238	0.027	U	0.046	1.00	0.034	180	09/05/09	09/10/09
Plutonium 239/40	0.024	J	0.035	1.00	0.017	180	09/05/09	09/10/09

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

Tetra Tech EC, Inc.

Client Sample ID: 72AB140-021 DUP

Radiochemistry

Lab Sample ID: F9I030195-001X
 Work Order: LJ9RD
 Matrix: SOLID

Date Collected: 07/15/09 1330
 Date Received: 09/03/09 0920

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Total SR BY GFPC	EPA-905 MOD			pCi/g		Batch # 9246456		Yld % 73
Strontium Total	0.16	J	0.16	0.32	0.16	200	09/03/09	09/09/09
Iso PLUTONIUM (SHORT CT)	DOE A-01-R MOD			pCi/g		Batch # 9248060		Yld % 89
Plutonium 238	-0.005	U	0.024	1.00	0.030	180	09/05/09	09/10/09
Plutonium 239/40	0.039	J	0.043	1.00	0.015	180	09/05/09	09/10/09

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

- J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

METHOD BLANK REPORT

Radiochemistry

Client Lot ID: F9I030195

Matrix: SOLID

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Lab Sample ID Analysis Date
<hr/>								
Total SR BY GFPC	EPA-905 MOD		pCi/g		Batch # 9246456	Yld % 87		F9I030000-456B
Strontium Total	0.01	U	0.13	0.32	0.14	200	09/03/09	09/09/09
<hr/>								
Iso PLUTONIUM (SHORT CT)	DOE A-01-R MOD		pCi/g		Batch # 9248060	Yld % 85		F9I050000-060B
Plutonium 238	-0.0061	U	0.0071	1.00	0.019	180	09/05/09	09/10/09
Plutonium 239/40	0.0	U	0.0094	1.00	0.011	180	09/05/09	09/10/09

NOTE(S)

Data are incomplete without the case narrative.

Bold results are greater than the MDL

U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection". Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

LOT# F9I030195

7 of 12

ED_006787_00017035-00052

Laboratory Control Sample Report

Radiochemistry

Client Lot ID: F9I030195
 Matrix: SOLID

Parameter	Spike Amount	Result	Total Uncert. (2 σ +/-)	MDL	% Yld	% Rec	Lab Sample ID QC Control Limits
Total SR BY GFPC	EPA-905 MOD		pCi/g	905 MOD			F9I030000-456C
Strontium Total	6.87	6.12	0.60	0.13	91	89	(83 - 110)
	Batch #:	9246456		Analysis Date:	09/09/09		
Iso PLUTONIUM (SHORT CT) MOD	DOE A-01-R		pCi/g	A-01-R			F9I050000-060C
Plutonium 238	6.15	5.29	0.63	0.009	104	86	(64 - 118)
Plutonium 239/40	13.2	11.7	1.2	0.009	104	88	(75 - 118)
	Batch #:	9248060		Analysis Date:	09/10/09		

NOTE(S)

Calculations are performed before rounding to avoid round-off error in calculated results

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214
 LOT# F9I030195

DUPLICATE EVALUATION REPORT

Radiochemistry

Client Lot ID: F9I030195

Date Sampled: 07/15/09

Matrix: SOLID

Date Received: 09/03/09

Parameter	SAMPLE Result		Total Uncert. (2σ+/-)	% Yld	DUPLICATE Result	Total Uncert. (2 σ+/-)	% Yld	QC Sample ID	
								Precision	
Total SR BY GFPC	EPA-905 MOD			pCi/g	905 MOD			F9I030195-001	
Strontium Total	0.17	J	0.15	78	0.16	J	0.16	73	2
	Batch #:		9246456	(Sample)	9246456	(Duplicate)			%RPD
Iso PLUTONIUM (SHORT CT)	DOE A-01-R MOD			pCi/g	A-01-R			F9I030195-001	
Plutonium 238	0.027	U	0.046	96	-0.005	U	0.024	89	298
Plutonium 239/40	0.024	J	0.035	96	0.039	J	0.043	89	47
	Batch #:		9248060	(Sample)	9248060	(Duplicate)			%RPD

NOTE(S)

Data are incomplete without the case narrative.

Calculations are performed before rounding to avoid round-off error in calculated results

J Result is greater than sample detection limit but less than stated reporting limit.

U Result is less than the sample detection limit.

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

LOT# F9I030195

9 of 12

ED_006787_00017035-00054

F9I030195**CLIENT ANALYSIS SUMMARY**

Storage Loc:

RAD

Project Manager: IV

Quote #: 79957

SDG:

Date Received:

2009-09-03

Project: CTO72X

HPS Projects

Analytical Due Date:

2009-09-15

PO#: 1036773-

Report to: Lisa Blenkowski

Report Due Date:

2009-09-17

Client: 494696 Tetra Tech EC, Inc.

Report Type: X

#SMPS in LOT: 1

EDD Code: 00

This project requires compliance with the DOD QSM. Please refer to client memorandum #4. Login separate project numbers in separate lots. Change CTO number.

LOGIN - Please login chemistry and radiochemistry into two separate lots, up to 20 samples per lot. NO RAD SCREEN FOR GAMMA ANALYSIS!!! ALL OTHERS - SCREEN

rad screen only for waters and solid 8-00 AFTER gamma data is released SEE BELOW FOR MORE INFO

CALENDAR DAYS FOR ALL TATs!!! General Comments DO NOT USE GE S/N

SAMPLE #	CLIENT SAMPLE ID	Site ID	Client Matrix	DATE/TIME SAMPLED	WORKORDER	A
1	72AB140-021			2009-07-15 / 1330	LJ9RD	SOLID
SAMPLE COMMENTS:						
XX ZV	RAD SCREEN	SOLID, RAD SCREEN	RA IN-HOUSE RAD SCREEN	01 STANDARD TEST SET	PROT: A	WRK LOC 06
XX 2H	EML A-01- R	SOLID, A-01-R MOD, Iso Pu	J2 Extraction Chromatography - Sequential Actinides	DQ DOD QSM V3	PROT: R	WRK LOC 06
XX ZM	EPA 905 MOD	SOLID, 905 MOD, Total Sr	FW Dry, Grind, Digest, Precipitate, Separation	01 STANDARD TEST SET	PROT: R	WRK LOC 06
X XX ZM	EPA 905 MOD	SOLID, 905 MOD, Total Sr	FW Dry, Grind, Digest, Precipitate, Separation	01 STANDARD TEST SET	PROT: R	WRK LOC 06

LOT# F91030195



TETRA TECH
2300 Columbia Street, Suite 700
San Diego, CA 92101 (619) 234-8866

CHAIN-OF-CUSTODY RECORD

NUMBER 30262

PROJECT NAME LPS		PROJECT ORDER NO. 1036773-6		ANALYSES REQUIRED		LABORATORY NAME TestAmerica	
PROJECT LOCATION CT072X		PROJECT NO. 1990.072X		ISO Pb* EPA 905 SILENT AI/A		LABORATORY ID FOR LABORATORY	
SAMPLE NAME Various		ANALYST NAME 869108244426				COMMENTS	
PROJECT CONTACT Sana Sudoko		PROJECT CONTACT PHONE NUMBER 949-756-7592					
SAMPLE ID	DATE COLLECTED	TIME COLLECTED	NO. OF CONTAINERS	LEVEL	TYPE	STATUS	COMMENTS
72AB/40-021	7/15/09	1330	1	X	S	1st day	250g
<div style="text-align: center;">AI/A</div>							
RECEIVED BY (Signature) R. Smith		DATE 7/15/09		LABORATORY INSTRUCTIONS/COMMENTS *ISO Pb including Pb238, Pb239 *Criteria of total Strontium should be any			
COMPANY NWID		TIME					
RECEIVED BY (Signature)		DATE		COMMENTS/DESCRIPTION Results greater than or equal to 0.331 pCi/g should be analyzed for Sr90/DDE Sr03 R:100			
COMPANY		TIME					
RECEIVED BY (Signature)		DATE		SAMPLE CONDITION UPON RECEIPT (FOR LABORATORY)			
COMPANY		TIME		TEMPERATURE: _____ SAMPLE CONDITION: <input type="checkbox"/> INTACT <input type="checkbox"/> BROKEN			
				COOLER SEAL: <input type="checkbox"/> INTACT <input type="checkbox"/> BROKEN			

White - Laboratory; Pink - Laboratory; Green - Project File; Manila - Data Management

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Lot #(s):

F9I030195

F9I030219

197

252

198

257

217

218

CONDITION UPON RECEIPT FORM

Client: Tetra Tech

Quote No: 79957, 75395

COC/RFA No: Below

Initiated By: AB

Date: 179

9-3-09

Time: 9:20

Shipping Information

Shipper: FedEx

UPS

DHL

Courier

Client

Other:

Multiple Packages:

N

Shipping # (s):*

Sample Temperature (s):**

1. 8691 0824 4426

6.

1. Ambient

6.

2. 7979 0038 4442

7.

2. ↓

7.

3. 7969 1284 4748

8.

3. ↓

8.

4.

9.

4.

9.

5.

10.

5.

10.

*Numbered shipping lines correspond to Numbered Sample Temp lines

**Sample must be received at 4°C ± 2°C. If not, note contents below. Temperature variance does NOT affect the following: Metals-Liquid or Rad tests- Liquid or Solids

Condition (Circle "Y" for yes, "N" for no and "N/A" for not applicable):

1. <input checked="" type="radio"/> Y <input type="radio"/> N	Are there custody seals present on the cooler?	8. <input type="radio"/> Y <input checked="" type="radio"/> N	Are there custody seals present on bottles?
2. <input type="radio"/> Y <input checked="" type="radio"/> N <input type="radio"/> N/A	Do custody seals on cooler appear to be tampered with?	9. <input type="radio"/> Y <input type="radio"/> N <input checked="" type="radio"/> N/A	Do custody seals on bottles appear to be tampered with?
3. <input checked="" type="radio"/> Y <input type="radio"/> N	Were contents of cooler frisked after opening, but before unpacking?	10. <input type="radio"/> Y <input type="radio"/> N <input checked="" type="radio"/> N/A	Was sample received with proper pH? (If not, make note below)
4. <input checked="" type="radio"/> Y <input type="radio"/> N	Sample received with Chain of Custody?	11. <input checked="" type="radio"/> Y <input type="radio"/> N	Sample received in proper containers?
5. <input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A	Does the Chain of Custody match sample ID's on the container(s)?	12. <input type="radio"/> Y <input type="radio"/> N <input checked="" type="radio"/> N/A	Headspace in VOA or TOX liquid samples? (If Yes, note sample ID's below)
6. <input type="radio"/> Y <input checked="" type="radio"/> N	Was sample received broken?	13. <input type="radio"/> Y <input type="radio"/> N <input checked="" type="radio"/> N/A	Was Internal COC/Workshare received?
7. <input checked="" type="radio"/> Y <input type="radio"/> N	Is sample volume sufficient for analysis?	14. <input type="radio"/> Y <input type="radio"/> N <input checked="" type="radio"/> N/A	Was pH taken by original TestAmerica lab?

† For DOE-AL (Pantex, LANL, Sandia) sites, pH of ALL containers received must be verified, EXCEPT VOA, TOX and soils.

Notes: COC - 30262

38048

60

49

57

↓ 50

58

↓ 59

38047

↓ 147

↓ 148

Corrective Action:

☐ Client Contact Name:

Informed by:

☐ Sample(s) processed "as is"☐ Sample(s) on hold until:

If released, notify:

Project Management Review:

Date:

9-4-09

THIS FORM MUST BE COMPLETED AT THE TIME THE ITEMS ARE BEING CHECKED IN. IF ANY ITEM IS COMPLETED BY SOMEONE OTHER THAN THE INITIATOR, THEN THAT PERSON IS REQUIRED TO APPLY THEIR INITIAL AND THE DATE NEXT TO THAT ITEM.

ADMIN-0004, REVISED 10/21/08 \\slvr01\QA\FORMS\ST-LOUIS\ADMIN\Admin004 rev11.doc

ATTACHMENT 3

RESRAD MODELING

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Summary : Building 140 Discharge Piping

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\ALAMEDA OU2C\BUILDING 140.RAD

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Dose Conversion Factor (and Related) Parameter Summary ...	2
Site-Specific Parameter Summary	3
Summary of Pathway Selections	7
Contaminated Zone and Total Dose Summary	8
Total Dose Components	
Time = 0.000E+00	9
Time = 1.000E+00	10
Time = 3.000E+00	11
Time = 1.000E+01	12
Time = 3.000E+01	13
Time = 1.000E+02	14
Time = 3.000E+02	15
Time = 1.000E+03	16
Dose/Source Ratios Summed Over All Pathways	17
Single Radionuclide Soil Guidelines	17
Dose Per Nuclide Summed Over All Pathways	18
Soil Concentration Per Nuclide	18

Summary : Building 140 Discharge Piping

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\ALAMEDA OU2C\BUILDING 140.RAD

Dose Conversion Factor (and Related) Parameter Summary

Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
A-1	DCF's for external ground radiation, (mrem/yr)/(pCi/g)			
A-1	Ba-137m (Source: FGR 12)	3.606E+00	3.606E+00	DCF1(1)
A-1	Cs-137 (Source: FGR 12)	7.510E-04	7.510E-04	DCF1(2)
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Cs-137+D	3.190E-05	3.190E-05	DCF2(1)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Cs-137+D	5.000E-05	5.000E-05	DCF3(1)
D-34	Food transfer factors:			
D-34	Cs-137+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(1,1)
D-34	Cs-137+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(1,2)
D-34	Cs-137+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(1,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Cs-137+D , fish	2.000E+03	2.000E+03	BIOFAC(1,1)
D-5	Cs-137+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(1,2)

#For DCF1(xxx) only, factors are for infinite depth & area. See ETFG table in Ground Pathway of Detailed Report.

*Base Case means Default.Lib w/o Associate Nuclide contributions.

Summary : Building 140 Discharge Piping

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\ALAMEDA OU2C\BUILDING 140.RAD

Site-Specific Parameter Summary

Menu	Parameter	User		Used by RESRAD	Parameter Name
		Input	Default	(If different from user input)	
R011	Area of contaminated zone (m**2)	2.700E+01	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	1.200E+00	2.000E+00	---	THICK0
R011	Fraction of contamination that is submerged	0.000E+00	0.000E+00	---	SUBMFRACT
R011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Cs-137	2.043E-01	0.000E+00	---	S1(1)
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00	---	W1(1)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	V CZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW

Summary : Building 140 Discharge Piping

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\ALAMEDA OU2C\BUILDING 140.RAD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	4.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	2.000E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	4.600E+03	4.600E+03	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	4.600E+03	4.600E+03	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	4.600E+03	4.600E+03	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.038E-05	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	5.000E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	2.500E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)

Summary : Building 140 Discharge Piping

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\ALAMEDA OU2C\BUILDING 140.RAD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	9.200E+01	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	6.300E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	5.400E+00	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	5.100E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.135E-01	FPLANT
R018	Contamination fraction of meat	-1	-1	0.135E-02	FMEAT
R018	Contamination fraction of milk	-1	-1	0.135E-02	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	1.100E+00	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	8.000E-02	8.000E-02	---	TE(3)

Summary : Building 140 Discharge Piping

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\ALAMEDA OU2C\BUILDING 140.RAD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	1.000E+00	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSNI
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSNI
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS

Summary : Building 140 Discharge Piping

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\ALAMEDA OU2C\BUILDING 140.RAD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	active
4 -- meat ingestion	active
5 -- milk ingestion	active
6 -- aquatic foods	active
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	suppressed

Summary : Building 140 Discharge Piping

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\ALAMEDA OU2C\BUILDING 140.RAD

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	27.00 square meters	Cs-137	2.043E-01
Thickness:	1.20 meters		
Cover Depth:	0.00 meters		

Total Dose TDOSE(t), mrem/yr

Basic Radiation Dose Limit = 2.500E+01 mrem/yr

Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	2.596E-01	2.536E-01	2.421E-01	2.059E-01	1.296E-01	2.560E-02	2.489E-04	2.065E-11
M(t):	1.038E-02	1.015E-02	9.686E-03	8.236E-03	5.182E-03	1.024E-03	9.957E-06	8.262E-13

Maximum TDOSE(t): 2.596E-01 mrem/yr at t = 0.000E+00 years

Summary : Building 140 Discharge Piping

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-137	2.585E-01	0.9959	2.211E-07	0.0000	0.000E+00	0.0000	9.488E-04	0.0037	8.297E-05	0.0003	2.709E-05	0.0001	7.463E-06	0.0000
Total	2.585E-01	0.9959	2.211E-07	0.0000	0.000E+00	0.0000	9.488E-04	0.0037	8.297E-05	0.0003	2.709E-05	0.0001	7.463E-06	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.596E-01	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.596E-01	1.0000

*Sum of all water independent and dependent pathways.

Summary : Building 140 Discharge Piping

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-137	2.526E-01	0.9959	2.160E-07	0.0000	0.000E+00	0.0000	9.271E-04	0.0037	8.107E-05	0.0003	2.647E-05	0.0001	7.292E-06	0.0000
Total	2.526E-01	0.9959	2.160E-07	0.0000	0.000E+00	0.0000	9.271E-04	0.0037	8.107E-05	0.0003	2.647E-05	0.0001	7.292E-06	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.536E-01	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.536E-01	1.0000

*Sum of all water independent and dependent pathways.

Summary : Building 140 Discharge Piping

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-137	2.412E-01	0.9959	2.063E-07	0.0000	0.000E+00	0.0000	8.851E-04	0.0037	7.740E-05	0.0003	2.527E-05	0.0001	6.962E-06	0.0000
Total	2.412E-01	0.9959	2.063E-07	0.0000	0.000E+00	0.0000	8.851E-04	0.0037	7.740E-05	0.0003	2.527E-05	0.0001	6.962E-06	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.421E-01	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.421E-01	1.0000

*Sum of all water independent and dependent pathways.

Summary : Building 140 Discharge Piping

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-137	2.051E-01	0.9959	1.754E-07	0.0000	0.000E+00	0.0000	7.526E-04	0.0037	6.581E-05	0.0003	2.149E-05	0.0001	5.920E-06	0.0000
Total	2.051E-01	0.9959	1.754E-07	0.0000	0.000E+00	0.0000	7.526E-04	0.0037	6.581E-05	0.0003	2.149E-05	0.0001	5.920E-06	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.059E-01	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.059E-01	1.0000

*Sum of all water independent and dependent pathways.

Summary : Building 140 Discharge Piping

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-137	1.290E-01	0.9959	1.104E-07	0.0000	0.000E+00	0.0000	4.735E-04	0.0037	4.141E-05	0.0003	1.352E-05	0.0001	3.725E-06	0.0000
Total	1.290E-01	0.9959	1.104E-07	0.0000	0.000E+00	0.0000	4.735E-04	0.0037	4.141E-05	0.0003	1.352E-05	0.0001	3.725E-06	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.296E-01	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.296E-01	1.0000

*Sum of all water independent and dependent pathways.

Summary : Building 140 Discharge Piping

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-137	2.549E-02	0.9959	2.180E-08	0.0000	0.000E+00	0.0000	9.356E-05	0.0037	8.182E-06	0.0003	2.672E-06	0.0001	7.360E-07	0.0000
Total	2.549E-02	0.9959	2.180E-08	0.0000	0.000E+00	0.0000	9.356E-05	0.0037	8.182E-06	0.0003	2.672E-06	0.0001	7.360E-07	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.560E-02	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.560E-02	1.0000

*Sum of all water independent and dependent pathways.

Summary : Building 140 Discharge Piping

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-137	2.479E-04	0.9959	2.120E-10	0.0000	0.000E+00	0.0000	9.094E-07	0.0037	7.954E-08	0.0003	2.597E-08	0.0001	7.158E-09	0.0000
Total	2.479E-04	0.9959	2.120E-10	0.0000	0.000E+00	0.0000	9.094E-07	0.0037	7.954E-08	0.0003	2.597E-08	0.0001	7.158E-09	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.489E-04	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.489E-04	1.0000

*Sum of all water independent and dependent pathways.

Summary : Building 140 Discharge Piping

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-137	2.063E-11	0.9989	1.923E-17	0.0000	0.000E+00	0.0000	1.830E-14	0.0009	2.473E-15	0.0001	8.624E-16	0.0000	6.492E-16	0.0000
Total	2.063E-11	0.9989	1.923E-17	0.0000	0.000E+00	0.0000	1.830E-14	0.0009	2.473E-15	0.0001	8.624E-16	0.0000	6.492E-16	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.065E-11	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.065E-11	1.0000

*Sum of all water independent and dependent pathways.

Summary : Building 140 Discharge Piping

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Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent	Product	Thread	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g)							
(i)	(j)	Fraction	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Cs-137+D	Cs-137+D	1.000E+00	1.271E+00	1.241E+00	1.185E+00	1.008E+00	6.341E-01	1.253E-01	1.218E-03	1.011E-10

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 mrem/yr

Nuclide	t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Cs-137		1.968E+01	2.014E+01	2.109E+01	2.481E+01	3.942E+01	1.995E+02	2.052E+04	2.473E+11

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 0.000E+00 years

Nuclide	Initial	tmin	DSR(i,tmin)	G(i,tmin)	DSR(i,tmax)	G(i,tmax)
(i)	(pCi/g)	(years)		(pCi/g)		(pCi/g)
Cs-137	2.043E-01	0.000E+00	1.271E+00	1.968E+01	1.271E+00	1.968E+01

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Individual Nuclide Dose Summed Over All Pathways

Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	DOSE(j,t), mrem/yr							
			t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02
Cs-137	Cs-137	1.000E+00	2.596E-01	2.536E-01	2.421E-01	2.059E-01	1.296E-01	2.560E-02	2.489E-04	2.065E-11

THF(i) is the thread fraction of the parent nuclide.

Individual Nuclide Soil Concentration

Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	S(j,t), pCi/g							
			t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02
Cs-137	Cs-137	1.000E+00	2.043E-01	1.996E-01	1.906E-01	1.621E-01	1.020E-01	2.015E-02	1.959E-04	1.777E-11

THF(i) is the thread fraction of the parent nuclide.

RESRAD.EXE execution time = 0.67 seconds

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Table of Contents

Part III: Intake Quantities and Health Risk Factors

Cancer Risk Slope Factors	2
Risk Slope and ETFG for the Ground Pathway	3
Amount of Intake Quantities and Excess Cancer Risks	
Time= 0.000E+00	4
Time= 1.000E+00	6
Time= 3.000E+00	8
Time= 1.000E+01	10
Time= 3.000E+01	12
Time= 1.000E+02	14
Time= 3.000E+02	16
Time= 1.000E+03	18

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Cancer Risk Slope Factors Summary Table

Risk Library: FGR 13 Morbidity

Menu	Parameter	Current Value	Base Case*	Parameter Name
Sf-1	Ground external radiation slope factors, 1/yr per (pCi/g):			
Sf-1	Cs-137+D	2.55E-06	5.32E-10	SLPF(1,1)
Sf-2	Inhalation, slope factors, 1/(pCi):			
Sf-2	Cs-137+D	1.12E-10	1.12E-10	SLPF(1,2)
Sf-3	Food ingestion, slope factors, 1/(pCi):			
Sf-3	Cs-137+D	3.74E-11	3.74E-11	SLPF(1,3)
Sf-3	Water ingestion, slope factors, 1/(pCi):			
Sf-3	Cs-137+D	3.04E-11	3.04E-11	SLPF(1,4)
Sf-3	Soil ingestion, slope factors, 1/(pCi):			
Sf-3	Cs-137+D	3.74E-11	3.74E-11	SLPF(1,5)

*Base Case means Default.Lib w/o Associate Nuclide contributions.

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Risk Slope and Environmental Transport Factors for the Ground Pathway

Nuclide (i)	Slope(i)*		ETFG(i,t) At Time in Years (dimensionless)						
	t=		0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02
Ba-137m	2.690E-06	3.752E-01	3.752E-01	3.752E-01	3.752E-01	3.752E-01	3.752E-01	3.752E-01	3.444E-01
Cs-137	5.320E-10	3.934E-01	3.934E-01	3.934E-01	3.934E-01	3.934E-01	3.934E-01	3.934E-01	3.833E-01

* - Units are 1/yr per (pCi/g) at infinite depth and area. Multiplication by ETFG(i,t) converts to site conditions.

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Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As pCi/yr at t= 0.000E+00 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Ingestion*
Cs-137	7.012E-03	1.920E+01	1.679E+00	5.481E-01	1.510E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.157E+01

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)

and Fraction of Total Risk at t= 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	4.218E-06	0.9959	1.698E-11	0.0000	1.552E-08	0.0037	1.357E-09	0.0003	4.433E-10	0.0001	1.221E-10	0.0000
Total	4.218E-06	0.9959	1.698E-11	0.0000	1.552E-08	0.0037	1.357E-09	0.0003	4.433E-10	0.0001	1.221E-10	0.0000

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)

and Fraction of Total Risk at t= 0.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.236E-06	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.236E-06	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)

and Fraction of Total Risk at t= 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	4.218E-06	0.9959	1.698E-11	0.0000	0.000E+00	0.0000	1.552E-08	0.0037	1.357E-09	0.0003	4.433E-10	0.0001	1.221E-10	0.0000
Total	4.218E-06	0.9959	1.698E-11	0.0000	0.000E+00	0.0000	1.552E-08	0.0037	1.357E-09	0.0003	4.433E-10	0.0001	1.221E-10	0.0000

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Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 0.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.236E-06	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.236E-06	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

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Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As pCi/yr at t= 1.000E+00 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Ingestion*
Cs-137	6.851E-03	1.876E+01	1.640E+00	5.356E-01	1.475E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.108E+01

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)

and Fraction of Total Risk at t= 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	4.122E-06	0.9959	1.659E-11	0.0000	1.517E-08	0.0037	1.326E-09	0.0003	4.331E-10	0.0001	1.193E-10	0.0000
Total	4.122E-06	0.9959	1.659E-11	0.0000	1.517E-08	0.0037	1.326E-09	0.0003	4.331E-10	0.0001	1.193E-10	0.0000

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)

and Fraction of Total Risk at t= 1.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.139E-06	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.139E-06	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)

and Fraction of Total Risk at t= 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	4.122E-06	0.9959	1.659E-11	0.0000	0.000E+00	0.0000	1.517E-08	0.0037	1.326E-09	0.0003	4.331E-10	0.0001	1.193E-10	0.0000
Total	4.122E-06	0.9959	1.659E-11	0.0000	0.000E+00	0.0000	1.517E-08	0.0037	1.326E-09	0.0003	4.331E-10	0.0001	1.193E-10	0.0000

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Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.139E-06	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.139E-06	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

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Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As pCi/yr at t= 3.000E+00 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Ingestion*
Cs-137	6.541E-03	1.791E+01	1.566E+00	5.113E-01	1.409E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.013E+01

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)

and Fraction of Total Risk at t= 3.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	3.935E-06	0.9959	1.584E-11	0.0000	1.448E-08	0.0037	1.266E-09	0.0003	4.135E-10	0.0001	1.139E-10	0.0000
Total	3.935E-06	0.9959	1.584E-11	0.0000	1.448E-08	0.0037	1.266E-09	0.0003	4.135E-10	0.0001	1.139E-10	0.0000

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)

and Fraction of Total Risk at t= 3.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.951E-06	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.951E-06	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)

and Fraction of Total Risk at t= 3.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	3.935E-06	0.9959	1.584E-11	0.0000	0.000E+00	0.0000	1.448E-08	0.0037	1.266E-09	0.0003	4.135E-10	0.0001	1.139E-10	0.0000
Total	3.935E-06	0.9959	1.584E-11	0.0000	0.000E+00	0.0000	1.448E-08	0.0037	1.266E-09	0.0003	4.135E-10	0.0001	1.139E-10	0.0000

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Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.951E-06	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.951E-06	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

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Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As pCi/yr at t= 1.000E+01 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Ingestion*
Cs-137	5.562E-03	1.523E+01	1.332E+00	4.348E-01	1.198E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.711E+01

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)

and Fraction of Total Risk at t= 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	3.346E-06	0.9959	1.347E-11	0.0000	1.231E-08	0.0037	1.077E-09	0.0003	3.516E-10	0.0001	9.687E-11	0.0000
Total	3.346E-06	0.9959	1.347E-11	0.0000	1.231E-08	0.0037	1.077E-09	0.0003	3.516E-10	0.0001	9.687E-11	0.0000

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)

and Fraction of Total Risk at t= 1.000E+01 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.360E-06	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.360E-06	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)

and Fraction of Total Risk at t= 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	3.346E-06	0.9959	1.347E-11	0.0000	0.000E+00	0.0000	1.231E-08	0.0037	1.077E-09	0.0003	3.516E-10	0.0001	9.687E-11	0.0000
Total	3.346E-06	0.9959	1.347E-11	0.0000	0.000E+00	0.0000	1.231E-08	0.0037	1.077E-09	0.0003	3.516E-10	0.0001	9.687E-11	0.0000

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Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+01 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.360E-06	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.360E-06	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

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Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As pCi/yr at t= 3.000E+01 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Ingestion*
Cs-137	3.499E-03	9.581E+00	8.378E-01	2.736E-01	7.536E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.077E+01

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)

and Fraction of Total Risk at t= 3.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	2.105E-06	0.9959	8.475E-12	0.0000	7.748E-09	0.0037	6.775E-10	0.0003	2.212E-10	0.0001	6.095E-11	0.0000
Total	2.105E-06	0.9959	8.475E-12	0.0000	7.748E-09	0.0037	6.775E-10	0.0003	2.212E-10	0.0001	6.095E-11	0.0000

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)

and Fraction of Total Risk at t= 3.000E+01 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.114E-06	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.114E-06	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)

and Fraction of Total Risk at t= 3.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	2.105E-06	0.9959	8.475E-12	0.0000	0.000E+00	0.0000	7.748E-09	0.0037	6.775E-10	0.0003	2.212E-10	0.0001	6.095E-11	0.0000
Total	2.105E-06	0.9959	8.475E-12	0.0000	0.000E+00	0.0000	7.748E-09	0.0037	6.775E-10	0.0003	2.212E-10	0.0001	6.095E-11	0.0000

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Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+01 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.114E-06	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.114E-06	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

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Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As pCi/yr at t= 1.000E+02 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Ingestion*
Cs-137	6.915E-04	1.893E+00	1.655E-01	5.405E-02	1.489E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.128E+00

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)

and Fraction of Total Risk at t= 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	4.160E-07	0.9959	1.675E-12	0.0000	1.531E-09	0.0037	1.339E-10	0.0003	4.371E-11	0.0001	1.204E-11	0.0000
Total	4.160E-07	0.9959	1.675E-12	0.0000	1.531E-09	0.0037	1.339E-10	0.0003	4.371E-11	0.0001	1.204E-11	0.0000

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)

and Fraction of Total Risk at t= 1.000E+02 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.177E-07	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.177E-07	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)

and Fraction of Total Risk at t= 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	4.160E-07	0.9959	1.675E-12	0.0000	0.000E+00	0.0000	1.531E-09	0.0037	1.339E-10	0.0003	4.371E-11	0.0001	1.204E-11	0.0000
Total	4.160E-07	0.9959	1.675E-12	0.0000	0.000E+00	0.0000	1.531E-09	0.0037	1.339E-10	0.0003	4.371E-11	0.0001	1.204E-11	0.0000

Intrisk : Building 140 Discharge Piping

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Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+02 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.177E-07	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.177E-07	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Intrisk : Building 140 Discharge Piping

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Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As pCi/yr at t= 3.000E+02 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Ingestion*
Cs-137	6.724E-06	1.841E-02	1.610E-03	5.257E-04	1.448E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.069E-02

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)

and Fraction of Total Risk at t= 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	4.045E-09	0.9959	1.629E-14	0.0000	1.467E-11	0.0036	1.286E-12	0.0003	4.200E-13	0.0001	1.171E-13	0.0000
Total	4.045E-09	0.9959	1.629E-14	0.0000	1.467E-11	0.0036	1.286E-12	0.0003	4.200E-13	0.0001	1.171E-13	0.0000

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)

and Fraction of Total Risk at t= 3.000E+02 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.062E-09	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.062E-09	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)

and Fraction of Total Risk at t= 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	4.045E-09	0.9959	1.629E-14	0.0000	0.000E+00	0.0000	1.467E-11	0.0036	1.286E-12	0.0003	4.200E-13	0.0001	1.171E-13	0.0000
Total	4.045E-09	0.9959	1.629E-14	0.0000	0.000E+00	0.0000	1.467E-11	0.0036	1.286E-12	0.0003	4.200E-13	0.0001	1.171E-13	0.0000

Intrisk : Building 140 Discharge Piping

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Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+02 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.062E-09	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.062E-09	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Intrisk : Building 140 Discharge Piping

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Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As pCi/yr at t= 1.000E+03 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Ingestion*
Cs-137	6.099E-13	3.712E-10	5.011E-11	1.747E-11	1.313E-11	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.519E-10

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)

and Fraction of Total Risk at t= 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	3.322E-16	0.9990	1.477E-21	0.0000	2.802E-19	0.0008	3.905E-20	0.0001	1.366E-20	0.0000	1.062E-20	0.0000
Total	3.322E-16	0.9990	1.477E-21	0.0000	2.802E-19	0.0008	3.905E-20	0.0001	1.366E-20	0.0000	1.062E-20	0.0000

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)

and Fraction of Total Risk at t= 1.000E+03 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.326E-16	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.326E-16	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)

and Fraction of Total Risk at t= 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	3.322E-16	0.9990	1.477E-21	0.0000	0.000E+00	0.0000	2.802E-19	0.0008	3.905E-20	0.0001	1.366E-20	0.0000	1.062E-20	0.0000
Total	3.322E-16	0.9990	1.477E-21	0.0000	0.000E+00	0.0000	2.802E-19	0.0008	3.905E-20	0.0001	1.366E-20	0.0000	1.062E-20	0.0000

Intrisk : Building 140 Discharge Piping

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Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+03 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.326E-16	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.326E-16	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

ATTACHMENT 4
RESPONSE TO COMMENTS

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RESPONSE TO COMMENTS
DRAFT TECHNICAL MEMORANDUM TO SUPPORT UNRESTRICTED RELEASE OF
BUILDING 140 INCLUDING THE SUCTION CHANNEL AND DISCHARGE PIPING
HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA

Comments from Mark Ripperda
Remedial Project Manager
U.S. Environmental Protection Agency, Region IX
Comments Dated: June 3, 2011

COMMENT	RESPONSE
<p>Comment 1.</p> <p>EPA concurs that the Suction Channel and base of the pump house do not pose a risk to human health and the environment from radiological constituents. The Suction Channel is a pipe that was flushed with millions of gallons of water and is unlikely to harbor any accumulation of contaminants. Samples from the Discharge Channel show risk levels below the acceptable screen of one-in-a-million. Conditions in the Discharge Channel would be indicative of conditions in both the Suction Channel and Pump House, and the Discharge Channel. Finally, the Suction Channel and pump intakes at the bottom of the Pump House are more than 50 feet below the surface.</p>	<p>Response 1.</p> <p>Comment noted.</p>
<p>Comment 2.</p> <p>Sections 2.5 and 2.6 state that no samples or measurements have been collected from the Suction Channel or Collector Channel. However, we have discussed sediment sampling collected either from the channel or intake sumps at several BCT meetings. Please either explain this discrepancy, or reference and summarize the work and state that it will be included in the Parcel F reports, or include and discuss all sampling in this report.</p>	<p>Response 2.</p> <p>Review of Drydock 3 record drawings and the HRA reveal the existence of a grated collector channel that runs beneath the floor of the drydock and is connected to the suction channel. This new information indicates that the sediment samples collected on June 11, 2008, are not, as previously reported, from the entrance to the suction channel but represent the bay sediments deposited on the bottom of the drydock (designated as part of Parcel F) directly over the collector channel. Because the suction channel is submerged to a depth of approximately 49 feet and can only be accessed from land on Parcel B by excavating to a depth of 56 feet bgs, no direct measurements or media samples from the suction channel have been collected.</p>

RESPONSE TO COMMENTS
DRAFT TECHNICAL MEMORANDUM TO SUPPORT UNRESTRICTED RELEASE OF
BUILDING 140 INCLUDING THE SUCTION CHANNEL AND DISCHARGE PIPING
HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA

Comment 3. Figure 1-3.

Please provide more detail on the collector channel, suction channel and sand traps. Is all the blue coloring representative of sand? Is the sand held in discrete boxes within the Collector Channel as shown in the full plan view? What is the interface between the Collector Channel and the Suction Channel?

Response 3.

The coloring provided in Figure 1-3 is to provide delineation of the components of the drydock pump-down system. Beginning from the drydock floor: "dark purple" corresponds to the Collector Channel, "light purple" corresponds to the Suction Channel, "yellow" corresponds to the discharge piping, and "orange" corresponds to the Discharge Channel. The "dark purple" Collector Channel may be filled with sand, but this is not known as the Collector Channel is inaccessible. The Collector Channel continues directly to the Suction Channel without additional piping components according to record drawings.

RESPONSE TO COMMENTS
DRAFT TECHNICAL MEMORANDUM TO SUPPORT UNRESTRICTED RELEASE OF
BUILDING 140 INCLUDING THE SUCTION CHANNEL AND DISCHARGE PIPING
HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA

Comments from Ryan Miya, Ph.D.
Senior Hazardous Substances Scientist
San Francisco Peninsula Team Leader
Brownfields and Environmental Restoration Program – Berkeley
Department of Toxic Substances Control
Comments Dated: June 22, 2011

COMMENT	RESPONSE
<p>Comment 1. Section 2.6 – Collector Channel.</p> <p>Please modify the text to indicate that any additional evaluation and investigation of the collector channel within Drydock 3 will be conducted as a component of the ongoing investigation and potential future remediation activities associated with Parcel F.</p>	<p>Response 1.</p> <p>The following has been added to Section 2.6: “Any additional evaluation and investigation of the collector channel within Drydock 3 will be conducted as a component of the ongoing investigation and potential future remediation activities associated with Parcel F.”</p>
<p>Comment 2. Section 3.0 – Results Evaluation. Paragraph seven.</p> <p>The text should be modified to emphasize that any potential future human exposure to potentially-impacted suction channel piping and sediment (if present at all) is very unlikely due to suction channel inaccessibility at least 49 feet below the existing ground surface. This will provide additional justification and clarification to explain why the Building 140 suction channel is not included as a component in the dose and risk evaluation as well as why suction channel direct measurements / samples are not necessary.</p>	<p>Response 2.</p> <p>The following has been added to the seventh paragraph in Section 3.0: “Any potential future human exposure to potentially impacted suction channel piping and sediment (if present at all) is very unlikely due to suction channel inaccessibility from its location at least 49 feet below the existing ground surface.”</p>

RESPONSE TO COMMENTS
DRAFT TECHNICAL MEMORANDUM TO SUPPORT UNRESTRICTED RELEASE OF
BUILDING 140 INCLUDING THE SUCTION CHANNEL AND DISCHARGE PIPING
HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA

Comments from Larry Morgan
Senior Health Physicist
Environmental Management Branch (EMB)
California Department of Public Health (CDPH)
Comments Dated: June 13, 2011

COMMENT	RESPONSE
The CDPH reviewed the document and has no comment.	No comment noted.